IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicants:	J. Boer et al.
Case:	6-2-2-5
Serial No.:	10/621,862
Filing Date:	July 17, 2003
Art Unit:	2611
Examiner:	Leila Malek
Title:	Signal Quality Estimation in a Wireless Communication System

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APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants (hereinafter "Appellants") hereby appeal the final rejection dated April 2, 2008 of claims 1-34 and 36-38 of the above-identified application.

REAL PARTY IN INTEREST

The present application is assigned of record to Agere Systems Inc. On April 2, 2007, the assignee Agere Systems Inc. completed a merger with LSI Logic Corporation, with the resulting entity being named LSI Corporation. LSI Corporation is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences.

STATUS OF CLAIMS

The present application was filed on July 17, 2003, with claims 1-38. Claims 1-38 are currently pending in the application. Claims 1, 16, 18, 23, 25, 34, 35, 37 and 38 are the independent claims.

Claims 1-34 and 36-38 stand finally rejected under 35 U.S.C. §103(a). Claim 35 is allowed. Claims 1-34 and 36-38 are appealed.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 is directed to a method for estimating a signal quality of a received signal in a wireless system comprising a wireless communication channel. The method includes a step of receiving a signal from the wireless communication channel. The received signal comprises at least one field that is modulated and encoded in a substantially fixed manner. The method includes another step of generating at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal. The channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. The method also includes a step of generating a signal quality estimate as a function of the at least one field in the received signal and the generated at least one reference field.

In an illustrative embodiment, a method for estimating a signal quality of a received signal in a wireless system (e.g., 100 in FIG. 1) comprising a wireless communication channel (e.g., 106 in FIG. 1) includes a step of receiving a signal (e.g., 200 in FIG. 2) from the wireless communication channel, as described in the specification at, for example, page 4, lines 21-26, and page 9, lines 26-28. As described in the specification at, for example, page 6, lines 10-15; page 6, line 25, to page 7, line 8; and page 9, line 26, to page 10, line 1, the received signal comprises at least one field (e.g., SIGNAL field 204 in FIG. 2, RECEIVED SIGNAL-FIELD 301 in FIG. 3) that is modulated and encoded in a substantially fixed manner. As described in the specification at, for example, page 9, line 26, to page 10, line 18, the method includes another step of generating (e.g., by multiplier 304 in FIG. 3) at least one reference field (e.g.,

REFERENCE SIGNAL-FIELD in FIG. 3) based, at least in part, on the at least one field in the received signal and on a channel estimation signal (e.g., 320 in FIG. 3). As described in the specification at, for example, page 10, lines 10-18, the channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. As described in the specification at, for example, page 11, lines 1-15, the method also includes a step of generating (e.g., by 308, 310, 312 in FIG. 3) a signal quality estimate (e.g., SQ 318 in FIG. 3) as a function of the at least one field in the received signal and the generated at least one reference field.

Independent claim 16 is directed to a method for estimating a signal quality of a received signal in a wireless system comprising a wireless communication channel. The method includes a step of receiving a signal from the wireless communication channel. The received signal comprises at least one field that is modulated and encoded in a substantially fixed manner. The method also includes steps of measuring at least one characteristic corresponding to the at least one field in the received signal; and generating a signal quality estimate as a function of the at least one characteristic corresponding to the at least one field in the received signal.

In an illustrative embodiment, a method for estimating a signal quality (e.g., SQ 318 in FIG. 3) of a received signal (e.g., 200 in FIG. 2) in a wireless system (e.g., 100 in FIG. 1) comprising a wireless communication channel (e.g., 106 in FIG. 1) includes a step of receiving a signal from the wireless communication channel, as described in the specification at, for example, page 4, lines 21-26, and page 9, lines 26-28. As described in the specification at, for example, page 6, lines 10-15; page 6, line 25, to page 7, line 8; and page 9, line 26, to page 10, line 1, the received signal comprises at least one field (e.g., SIGNAL field 204 in FIG. 2, RECEIVED SIGNAL-FIELD 301 in FIG. 3) that is modulated and encoded in a substantially fixed manner. The method also includes a step measuring (e.g., by comparator 308 in FIG. 3) at least one characteristic (e.g., a difference signal) corresponding to the at least one field in the received signal, as described in the specification at, for example, page 11, lines 1-17. The method includes a further step of generating (e.g., by 310, 312 in FIG. 3) a signal quality estimate (e.g., SQ 318 in FIG. 3) as a function (e.g., magnitude or power measurement) of the at least one characteristic corresponding to the at least one field in the received signal, as described in the specification at, for example, page 11, line 18, to page 12, line 4.

Independent claim 18 is directed to a method for controlling a data transmission rate of at least one transceiver in a wireless system. The at least one transceiver comprises a transmitter and a receiver and is configurable for communicating over a wireless communication channel. The method includes a step of receiving a signal from the wireless communication channel. The received signal comprises at least one field that is modulated and encoded in a substantially fixed manner. The method also includes a step of generating at least one reference field based at least in part on the at least one field in the received signal and on a channel estimation signal. The channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. The method also includes steps of comparing the at least one field in the received signal with the at least one reference field and generating a difference signal corresponding thereto; generating a signal quality estimate, the signal quality estimate being a function of the difference signal; and modifying the data transmission rate of the transmitter based, at least in part, on the signal quality estimate.

As described in the specification at, for example, page 5, lines 7-15, an illustrative embodiment includes a method for controlling a data transmission rate of at least one transceiver (e.g., 102 in FIG. 1) in a wireless system (e.g., 100 in FIG. 1). The at least one transceiver comprises a transmitter (e.g., 110 in FIG. 1) and a receiver (e.g., 108 in FIG. 1) and is configurable for communicating over a wireless communication channel (e.g., 106 in FIG. 1). The method includes a step of receiving a signal (e.g., 200 in FIG. 2) from the wireless communication channel, as described in the specification at, for example, page 4, lines 21-26, and page 9, lines 26-28. As described in the specification at, for example, page 6, lines 10-15; page 6, line 25, to page 7, line 8; and page 9, line 26, to page 10, line 1, the received signal comprises at least one field (e.g., SIGNAL field 204 in FIG. 2, RECEIVED SIGNAL-FIELD 301 in FIG. 3) that is modulated and encoded in a substantially fixed manner.

As described in the specification at, for example, page 9, line 26, to page 10, line 18, the method includes another step of generating (e.g., by multiplier 304 in FIG. 3) at least one reference field (e.g., REFERENCE SIGNAL-FIELD in FIG. 3) based, at least in part, on the at least one field in the received signal and on a channel estimation signal (e.g., 320 in FIG. 3). As described in the specification at, for example, page 10, lines 10-18, the channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel.

The method also includes a step of comparing (e.g., by comparator 308 in FIG. 3) the at least one field in the received signal with the at least one reference field and generating a difference signal corresponding thereto as described in the specification at, for example, page 11, lines 1-17. The method includes another step of generating (e.g., by 310, 312 in FIG. 3) a signal quality estimate (e.g., SQ 318 in FIG. 3), the signal quality estimate being a function (e.g., magnitude or power measurement) of the difference signal, as described in the specification at, for example, page 11, line 18, to page 12, line 4. As described in the specification at, for example, page 5, lines 7-15, and page 7, line 19, to page 8, line 27, the method further includes a step of modifying the data transmission rate of the transmitter based, at least in part, on the signal quality estimate.

Independent claim 23 is directed to a method for controlling a data transmission rate of at least one transceiver in a wireless system. The at least one transceiver comprises a transmitter and a receiver and is configurable for communicating over a wireless communication channel. The method includes a step of receiving a signal from the wireless communication channel. The received signal comprises a first field that is modulated and encoded in a substantially fixed manner and a second field having a variable modulation and encoding. The method also includes steps of measuring at least one characteristic corresponding to the first field in the received signal; generating a signal quality estimate as a function of a difference between the at least one characteristic corresponding to the first field in the received signal and at least one threshold corresponding to the at least one characteristic; and modifying at least one of the modulation and the encoding of the second field based, at least in part, on the signal quality estimate.

As described in the specification at, for example, page 5, lines 7-15, an illustrative embodiment includes a method for controlling a data transmission rate of at least one transceiver (e.g., 102 in FIG. 1) in a wireless system (e.g., 100 in FIG. 1). The at least one transceiver comprises a transmitter (e.g., 110 in FIG. 1) and a receiver (e.g., 108 in FIG. 1) and is configurable for communicating over a wireless communication channel (e.g., 106 in FIG. 1). The method includes a step of receiving a signal (e.g., 200 in FIG. 2) from the wireless communication channel, as described in the specification at, for example, page 4, lines 21-26, and page 9, lines 26-28. As described in the specification at, for example, page 6, lines 10-15; page 6, line 25, to page 7, line 8; and page 9, line 26, to page 10, line 1, the received signal

comprises at least one field (e.g., SIGNAL field 204 in FIG. 2, RECEIVED SIGNAL-FIELD 301 in FIG. 3) that is modulated and encoded in a substantially fixed manner.

As described in the specification at, for example, page 11, lines 1-17, the method also includes steps of measuring at least one characteristic (e.g., constellation points of the received SIGNAL field) corresponding to the first field in the received signal; and generating a signal quality estimate as a function of a difference between the at least one characteristic corresponding to the first field in the received signal and at least one threshold (e.g., constellation points of the reference SIGNAL field) corresponding to the at least one characteristic. As described in the specification at, for example, page 12, lines 16-22, the method further includes a step of modifying at least one of the modulation and the encoding of the second field based, at least in part, on the signal quality estimate.

Independent claim 25 is directed to a circuit for estimating a signal quality of a signal received from a wireless communication channel. The received signal comprises at least one field that is modulated and encoded in a substantially fixed manner. The circuit comprises at least one controller operative to generate at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal. The channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. The at least one controller is further operative to generate a signal quality estimate as a function of the at least one field in the received signal and the generated at least one reference field.

An illustrative embodiment includes a circuit (e.g., 300 in FIG. 3) for estimating a signal quality of a signal (e.g., 200 in FIG. 2) received from a wireless communication channel (e.g., 106 in FIG. 1), as described in the specification at, for example, page 4, lines 21-26, and page 9, lines 26-28. As described in the specification at, for example, page 6, lines 10-15; page 6, line 25, to page 7, line 8; and page 9, line 26, to page 10, line 1, the received signal comprises at least one field (e.g., SIGNAL field 204 in FIG. 2, RECEIVED SIGNAL-FIELD 301 in FIG. 3) that is modulated and encoded in a substantially fixed manner.

As described in the specification at, for example, page 12, line 23, to page 13, line 4, the circuit comprises at least one controller. As described in the specification at, for example, page 9, line 26, to page 10, line 18, the at least one controller (e.g., multiplier 304 in FIG. 3) is operative to generate at least one reference field (e.g., REFERENCE SIGNAL-FIELD in FIG. 3)

based, at least in part, on the at least one field in the received signal and on a channel estimation signal (e.g., 320 in FIG. 3). As described in the specification at, for example, page 10, lines 10-18, the channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. As described in the specification at, for example, page 11, lines 1-15, the at least one controller (e.g., by 308, 310, 312 in FIG. 3) is further operative to generate a signal quality estimate (e.g., SQ 318 in FIG. 3) as a function of the at least one field in the received signal and the generated at least one reference field.

Independent claim 34 is directed to a circuit for estimating a signal quality of a signal received from a wireless communication channel. The received signal comprises at least one field that is modulated and encoded in a substantially fixed manner. The circuit comprises a processor operative to generate at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal. The channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. The circuit further comprises a comparator coupled to the processor and configurable for generating a signal quality estimate as a function of a difference between the at least one reference field and the at least one field in the received signal.

An illustrative embodiment includes a circuit (e.g., 300 in FIG. 3) for estimating a signal quality of a signal (e.g., 200 in FIG. 2) received from a wireless communication channel (e.g., 106 in FIG. 1), as described in the specification at, for example, page 4, lines 21-26, and page 9, lines 26-28. As described in the specification at, for example, page 6, lines 10-15; page 6, line 25, to page 7, line 8; and page 9, line 26, to page 10, line 1, the received signal comprises at least one field (e.g., SIGNAL field 204 in FIG. 2, RECEIVED SIGNAL-FIELD 301 in FIG. 3) that is modulated and encoded in a substantially fixed manner.

As described in the specification at, for example, page 9, line 26, to page 10, line 18, the circuit comprises a processor (e.g., multiplier 304 in FIG. 3) operative to generate at least one reference field (e.g., REFERENCE SIGNAL-FIELD in FIG. 3) based, at least in part, on the at least one field in the received signal and on a channel estimation signal (e.g., 320 in FIG. 3). As described in the specification at, for example, page 10, lines 10-18, the channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. The circuit further comprises a comparator (e.g., 308 in FIG. 3) coupled to the processor and configurable for generating a signal quality estimate as a function

of a difference between the at least one reference field and the at least one field in the received signal, as described in the specification at, for example, page 11, lines 1-17.

Independent claim 37 is directed to a circuit for selectively adapting a data transmission rate of a wireless communication system comprising a transceiver comprising a receiver and a transmitter and being configurable for communication over a wireless communication channel. The circuit comprises at least one controller operative to receive a signal from the wireless communication channel. The received signal comprises at least one field that is modulated and encoded in a substantially fixed manner. The at least one controller is also operative to generate at least one reference field based at least in part on the at least one field and on a channel estimation signal. The channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. The at least one controller is further operative to compare the at least one field in the received signal with the at least one reference field and to generate a difference signal corresponding thereto; to generate a signal quality estimate, the signal quality estimate being a function of the difference signal; and to modify the data transmission rate of the transmitter based, at least in part, on the signal quality estimate.

An illustrative embodiment includes a circuit (e.g., 300 in FIG. 3) for selectively adapting a data transmission rate of a wireless communication system (e.g., 100 in FIG. 1) comprising a transceiver (e.g., 102 in FIG. 1) comprising a transmitter (e.g., 110 in FIG. 1) and a receiver (e.g., 108 in FIG. 1) and being configurable for communication over a wireless communication channel (e.g., 106 in FIG. 1). See the specification at, for example, page 4, lines 21-26, page 5, lines 7-15, and page 12, lines 23-25. As described in the specification at, for example, page 12, line 23, to page 13, line 4, the circuit comprises at least one controller.

As described in the specification at, for example, page 12, line 23, to page 13, line 4, the circuit comprises at least one controller. As described in the specification at, for example, page 9, line 26, to page 10, line 18, the at least one controller (e.g., multiplier 304 in FIG. 3) is operative to generate at least one reference field (e.g., REFERENCE SIGNAL-FIELD in FIG. 3) based, at least in part, on the at least one field in the received signal and on a channel estimation signal (e.g., 320 in FIG. 3). As described in the specification at, for example, page 10, lines 10-18, the channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel.

The at least one controller (e.g., comparator 308 in FIG. 3) is further operative to compare the at least one field in the received signal with the at least one reference field and tp generate a difference signal corresponding thereto, as described in the specification at, for example, page 11, lines 1-17. The at least one controller (e.g., 310, 312 in FIG. 3) is also operative to generate a signal quality estimate (e.g., SQ 318 in FIG. 3), the signal quality estimate being a function (e.g., magnitude or power measurement) of the difference signal, as described in the specification at, for example, page 11, line 18, to page 12, line 4. As described in the specification at, for example, page 5, lines 7-15, and page 7, line 19, to page 8, line 27, the at least one controller is further operative to modify the data transmission rate of the transmitter based, at least in part, on the signal quality estimate.

Independent claim 38 is directed to a semiconductor device including at least one circuit for estimating a signal quality of a signal received from a wireless communication channel. The received signal comprises at least one field that is modulated and encoded in a substantially fixed manner. The at least one circuit comprises at least one controller operative to generate at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal. The channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. The at least one controller is further operative to generate a signal quality estimate as a function of the at least one field in the received signal and the generated at least one reference field.

As described in the specification at, for example, page 4, lines 21-26; page 9, lines 26-28; page 12, lines 23-25; and page 13, lines 5-7, an illustrative embodiment includes a semiconductor device including at least one circuit (e.g., 300 in FIG. 3) for estimating a signal quality of a signal (e.g., 200 in FIG. 2) received from a wireless communication channel (e.g., 106 in FIG. 1). As described in the specification at, for example, page 6, lines 10-15; page 6, line 25, to page 7, line 8; and page 9, line 26, to page 10, line 1, the received signal comprises at least one field (e.g., SIGNAL field 204 in FIG. 2, RECEIVED SIGNAL-FIELD 301 in FIG. 3) that is modulated and encoded in a substantially fixed manner.

As described in the specification at, for example, page 12, line 23, to page 13, line 4, the circuit comprises at least one controller. As described in the specification at, for example, page 9, line 26, to page 10, line 18, the at least one controller (e.g., multiplier 304 in FIG. 3) is operative to generate at least one reference field (e.g., REFERENCE SIGNAL-FIELD in FIG. 3)

based, at least in part, on the at least one field in the received signal and on a channel estimation signal (e.g., 320 in FIG. 3). As described in the specification at, for example, page 10, lines 10-18, the channel estimation signal is distinct from the received signal and representative of at least one characteristic of the wireless communication channel. As described in the specification at, for example, page 11, lines 1-15, the at least one controller (e.g., by 308, 310, 312 in FIG. 3) is further operative to generate a signal quality estimate (e.g., SQ 318 in FIG. 3) as a function of the at least one field in the received signal and the generated at least one reference field.

The claimed invention provides a number of significant advantages over conventional arrangements. In an illustrative embodiment, as described in page 6, line 27, to page 7, line 4, an accurate signal quality estimation that is substantially independent of the payload data can be easily derived. As described in the specification at page 8, lines 6-15, another aspect of the present invention advantageously provides an improved rate-switching methodology which allows the wireless communication system to more optimally switch the transmission rate over the channel and is more reliable than conventional rate-switching approaches.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1, 5, 12-14, 16, 17, 25, 28, 33 and 38 are rejected under 35 U.S.C. §103(a) as being unpatentable over European Patent Application Publication No. EP1367752 (hereinafter "Sano") in view of U.S. Patent Application Publication No. 2004/0047296 (hereinafter "Tzannes").

2. Claims 2-4, 6, 26, 27, 29 and 34 are rejected under §103(a) as being unpatentable over Sano and Tzannes, further in view of U.S. Patent No. 6,522,696 (hereinafter "Mobin").

3. Claims 7-9, 18-20, 23, 24, 30, 31 and 37 are rejected under §103(a) as being unpatentable over Sano, Tzannes and Mobin, further in view of U.S. Patent No. 6,215,827 (hereinafter "Balachandran").

4. Claims 10 and 32 are rejected under §103(a) as being unpatentable over Sano, Tzannes and Mobin, further in view of U.S. Patent Application Publication No. 2003/0157914 (hereinafter "Li").

5. Claim 11 is rejected under §103(a) as being unpatentable over Sano, Tzannes and Li, further in view of Balachandran.

6. Claim 15 is rejected under §103(a) as being unpatentable over Sano and Tzannes, further in view of Balachandran.

7. Claims 21 and 22 are rejected under §103(a) as being unpatentable over Sano, Tzannes, Mobin and Balachandran, further in view of Li.

8. Claim 36 is rejected under §103(a) as being unpatentable over Sano, Tzannes, Mobin and Balachandran, further in view of U.S. Patent Application Publication No. 2005/0130595 (hereinafter "Shurvinton").

ARGUMENT

1. Rejection of claims 1, 5, 12-14, 16, 17, 25, 28, 33 and 38 under §103(a) over Sano and Tzannes.

Claims 1, 5, 12-14, 25, 33 and 38

In a response dated December 13, 2007, Appellants submitted a Declaration of Prior Invention in accordance with 37 CFR 1.131. The Declaration and the exhibits attached thereto evidence the actual reduction to practice of an invention falling within the present independent claims at least as early as March 12, 2001.

Appellants respectfully note that the Tzannes reference has a priority date of March 8, 2002. Appellants respectfully submit that the claims of the Tzannes reference and the claims of the present application are neither directed to the same invention nor are obvious variants of one another. Accordingly, Appellants respectfully submit that the Declaration is effective to remove Tzannes as §102(e) prior art and thus to overcome the present rejection.

On page 2, first paragraph, of the final Office Action dated April 2, 2008, and on page 2, first paragraph, of the Advisory Action dated June 5, 2008, the Examiner contends that the Declaration filed on December 13, 2007, is ineffective to remove these references from consideration.

On page 2, second paragraph, of the final Office Action and on page 2, second paragraph, of the Advisory Action, the Examiner states that the Declaration was signed by three of the four inventors named on the present application and contends that Appellants have failed to submit sufficient evidence that diligent efforts were made to reach the fourth inventor, Ra'anan Gil.

On June 5, 2008, Appellants submitted an Attorney Affidavit and related exhibits which show that, despite diligent efforts on the part of Appellants and their attorneys, the fourth

inventor was unable to be reached. The Attorney Affidavit was prepared by, and signed by, David E. Shifren, Reg. No. 59,329, who is an attorney of record in the present application. Mr. Shifren attested that he sent an electronic mail message to the inventors for whom Mr. Shifren had current contact information requesting current contact information for inventor Ra'anan Gil. Mr. Shifren received an electronic mail message including current contact information for Mr. Gil. Mr. Shifren sent five subsequent electronic mail communications to Mr. Gil. Despite there being no indication that these electronic mail messages were not received by Mr. Gil, Mr. Shifren never received any response from Mr. Gil.

On page 2, second paragraph, of the Advisory Action, the Examiner objects to the Attorney Affidavit under 37 CFR 1.47 and MPEP §§ 409.03(d) and 605.03. Specifically, the Examiner argues that "<u>certified mail return receipts</u>, and telegrams that support a finding that the non-signing inventor could not be found or reached should be made part of the statement. Appellants' representative does not show any proof that the un-signing inventor could not be reached at his last <u>mailing address</u>." (emphasis in original)

Appellants respectfully note that Mr. Gil's last known mailing address was in Israel. Appellants respectfully submit that, pursuant to the *Mailing Standards of the United States Postal Service* § 503.3.3.2, available at http://pe.usps.gov/text/DMM300/503.htm#3_3_2, "Certified Mail may be addressed for delivery only in the United States and its territories and possessions, through APOs and FPOs, or through the United Nations Post Office, New York." As such, Appellants are incapable of providing the certified mail return receipts requested by the Examiner.

The Examiner appears to be relying on, and misquoting from, a portion of MPEP 409.03(d) which states "[c]opies of <u>documentary evidence such as</u> internet searches, certified mail return receipts, cover letters of instructions, telegrams, that support a finding that the nonsigning inventor could not be found or reached should be made part of the statement." (emphasis supplied)

Nowhere does MPEP 409.03(d) state that certified mail return receipts are <u>required</u> in order to show diligence. Indeed, MPEP 409.03(d) specifically states that certified mail return receipts are merely one <u>example</u> of documentary evidence which may be submitted in order to support a finding that the nonsigning inventor could not be found or reached; this documentary evidence may also include, for example, internet searches and/or cover letters of instructions.

Indeed, MPEP 409.03(d) does not require that any documentary evidence be submitted along with the statement of facts. See, e.g., MPEP 409.03(d)(II) (where a refusal of the inventor to sign the application papers is alleged, proof that a *bona fide* attempt was made to present a copy of the application papers to the nonsigning inventor for signature may be sufficient; when there is an express oral refusal, that fact along with the time and place of the refusal must be stated in the statement of facts.)

Appellants further note that the CFR and MPEP sections cited by the Examiner are applicable only to the initial filing of an application and are thus inapplicable to the Declaration at issue. For example, MPEP 605.03 states that each applicant's mailing or post office address is required to be supplied on the oath or declaration.

Furthermore, Appellants are not relying on 37 CFR 1.47. Rather, Appellants are relying on *Ex parte Foster*, 1903 C.D. 213, 214, 105 O.G. 261 (Comm'r Pat. 1903) (cited in MPEP 715.04) ("The rule says that the inventor's affidavit will be sufficient; but it does not say that the fact may not be established in some other way. . . . The essential fact is priority of invention, and the Office may accept any satisfactory evidence of that fact. . . . Where the testimony of the inventor cannot be obtained, priority may in some cases be proved without his testimony"). Compare MPEP 715.04(I)(D) with MPEP 715.04(I)(C).

In the present case, Appellants respectfully submit that the Declaration signed by three of the four inventors, including the inventor who prepared the evidence relied upon in the Declaration, is sufficient to show actual reduction to practice even without the testimony of the fourth inventor.

On page 2, third paragraph, of the final Office Action, and on page 3, first paragraph, of the Advisory Action, the Examiner contends that the evidence "submitted is insufficient to establish a conception of the invention prior to the effective date" of the aforementioned references because the exhibits "fail to show some important features of the invention."

In the final Office Action on page 2, third paragraph, the Examiner gives as an example of such a feature that of "generating at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal, the channel estimation signal being distinct from the received signal and representative of at least one characteristic of the wireless communication channel."

Appellants respectfully submit that this feature is explicitly described in Exhibit 2 of the Declaration at page 2, third paragraph ("This implementation first scales the incoming samples according to the amplitude estimate of the channel and the power droop to position them around the reference points.") See also FIG. 1, showing the generation of a reference field based at least in part on SIGNAL-field (a field in the received signal) and amplitude_cor (a channel estimation signal distinct from the received signal and representative of at least one characteristic of the wireless communication channel).

In the Advisory Action on page 3, first paragraph, the Examiner gives as an example of such a feature that of "generating the signal quality estimate by measuring a difference between one or more constellation points associated with the at least one reference field and one or more corresponding points associated with the at least one field in the receiving signal."

Appellants respectfully submit that this feature is explicitly described in Exhibit 1 of the Declaration at page 2, second paragraph ("The idea behind the SQ indicator is measuring the Euclidean distance between the reference constellation points and the received constellation points. The closer the received constellation points are to the received constellation points the better SQ [sic].")

Appellants note that MPEP 715.02 states:

> The 37 CFR 1.131 affidavit or declaration must establish possession of either the whole invention claimed or something falling within the claim . . . in the sense that the claim as a whole reads on it. *In re Tanczyn*, 347 F.2d 830, 146 USPQ 298 (CCPA 1965) . . . .
>
> Further, a 37 CFR 1.131 affidavit is not insufficient merely because it does not show the identical disclosure of the reference(s) or the identical subject matter involved in the activity relied upon. If the affidavit contains facts showing a completion of the invention commensurate with the extent of the invention as claimed is shown in the reference or activity, the affidavit or declaration is sufficient, whether or not it is a showing of the identical disclosure of the reference or the identical subject matter involved in the activity. See *In re Wakefield*, 422 F.2d 897, 164 USPQ 636 (CCPA 1970).

It should be further noted that 37 CFR 1.131(b) states that, in order to antedate a reference, one must "establish reduction to practice prior to the effective date of the reference, or conception of the invention prior to the effective date of the reference coupled with due diligence from prior to said date to a subsequent reduction to practice or to the filing of the application." (emphasis supplied)

Appellants respectfully submit that because Appellants have established actual reduction to practice prior to the effective date of the reference, Appellants need not establish conception. See also MPEP 715.07(III) ("The showing of facts must be sufficient to show . . . actual reduction to practice of the invention prior to the effective date of the reference; or conception of the invention prior to the effective date of the reference coupled with due diligence from prior to the reference date to a subsequent . . . reduction to practice.")

In view of the foregoing, Appellants maintain that the Declaration of Prior Invention filed December 13, 2007, and the Attorney Affidavit filed June 5, 2008, are effective to remove Tzannes as §102(e) prior art and thus to overcome the present rejection.

Moreover, Appellants respectfully submit that the references cited in the present rejections, when considered either individually or in combination, fail to teach or suggest every limitation of independent claims 1, 25 and 38.

Independent claims 1, 25 and 38 are directed to a method, a circuit, and a semiconductor device, respectively, each of which contains similar limitations substantially directed toward "generating at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal . . . distinct from the received signal. . . and generating a signal quality estimate as a function of the at least one field in the received signal and the generated at least one reference field."

In formulating the present rejections of each of claims 1, 25 and 38, the Examiner argues that these limitations are taught by Sano at column 6, lines 44-58. Appellants respectfully submit that none of these limitations are taught or suggested by the relied-upon portions of Sano, which discloses:

> a channel estimating unit that calculates a channel estimate value for each subcarrier, by using the common pilot portion; a delay unit that delays each Fourier-transformed subcarrier signal by a time required to carry out the extraction processing, and the channel estimate processing; a fading compensating unit that carries out a fading compensation to each of the delayed subcarrier

> signals, by using each of the channel estimate values; an inverse spread spectrum unit that inverse spreads frequency of each of the fading-compensated subcarrier signals; an SIR estimating unit that estimates a signal-to-interference ratio by using the known series portion included in [the subcarrier group signal]

Appellants respectfully submit that the relied-upon portion of Sano fails to teach or suggest the claim limitation of generating a reference field based on a field of the received signal and on a distinct channel estimation signal. Instead, Sano teaches away from this limitation by teaching the calculation of a channel estimate value using a field in the received signal (the common pilot portion), then carrying out a fading compensation on the received signal based on this channel estimate value.

Contrast this with the techniques of the present invention, as described on page 10, lines 9-12 of the specification with reference to FIG. 3, wherein the channel estimation signal constitutes a distinct input from the received signal, rather than being based on the received signal itself: "The output of block 302 comprises the recovered SIGNAL field, which is subsequently used to generate a reference SIGNAL field. The recovered SIGNAL field generated by block 302 is fed to multiplier 304 where it is combined with a channel estimation signal presented to a second input 320 of the exemplary circuit 300."

The relied-upon portion of Sano also fails to teach or suggest the claim limitation of "generating a signal quality estimate as a function of the at least one field in the received signal and the generated at least one reference field." Here again, Sano teaches away by instead disclosing "a SIR estimating value that estimates a signal-to-interference ratio by using the known series portion included in the subcarrier group signal;" in other words, generating a signal quality estimate based on only one input, namely a field in the received signal. Additionally, it should be noted that Sano discloses only a technique requiring the incorporation of a known-series portion into the signal, whereas Appellants' invention permits the use of a signal which does not include a known series, such as the SIGNAL field as defined in the 802.11 specification.

Appellants respectfully submit that Tzannes fails to supplement Sano so as to teach or suggest at least the limitations discussed above, and thus the cited combination of Sano and Tzannes fails to teach or suggest all of the limitations recited in the subject claims. Accordingly,

independent claims 1, 25 and 38 are believed to be patentable over the proposed combination of references.

Dependent claims 5, 12-14, 28 and 33 are believed to be patentable at least by virtue of their respective dependencies from independent claims 1 and 25, which are believed to be patentable for at least the reasons identified above.

<u>Claims 16 and 17</u>

As discussed above with reference to independent claims 1, 25 and 38, Appellants respectfully assert that the previously-submitted Declaration of Prior Invention and accompanying exhibits attached thereto evidence the actual reduction to practice of an invention falling within the present independent claims at least as early as March 12, 2001.

Appellants respectfully note that the Tzannes reference has a priority date of March 8, 2002. Appellants respectfully submit that the claims of the Tzannes reference and the claims of the present application are neither directed to the same invention nor are obvious variants of one another. Accordingly, Appellants respectfully assert that the Declaration is effective to remove Tzannes as §102(e) prior art and thus to overcome the present rejection.

Moreover, Appellants respectfully submit that the references cited in the present rejections, when considered either individually or in combination, fail to teach or suggest every limitation of each claim.

Specifically, independent claim 16 is directed to a method including the steps of "measuring at least one characteristic corresponding to the at least one field in the received signal; and generating a signal quality estimate as a function of the at least one characteristic corresponding to the at least one field in the received signal." In formulating the present rejection of claim 16, the Examiner argues that these limitations are taught by Sano at column 6, lines 44-58. Appellants respectfully submit that none of these limitations are taught or suggested by the relied-upon portions of Sano. Rather, Sano teaches away from the subject claim by teaching the step of generating a signal quality estimate as a function of a <u>field</u> in the received signal rather than as a function of at least a <u>characteristic corresponding to a field</u> in the received signal: "an SIR estimating unit that estimates a signal-to-interference ratio by using the known series portion included in the subcarrier group signal."

Appellants respectfully submit that Tzannes fails to supplement Sano so as to teach or suggest at least the limitations discussed above. Accordingly, independent claim 16 is believed to be patentable over the proposed combination of references.

Dependent claim 17 is believed to be patentable at least by virtue of its dependency from independent claim 16, which is believed patentable for at least the reasons identified above.

2. Rejection of claims 2-4, 6, 26, 27, 29 and 34 under §103(a) over Sano, Tzannes and Mobin.

Claims 2-4, 6, 26, 27 and 29

Dependent claims 2-4, 6, 26, 27 and 29 are believed to be patentable at least by virtue of their respective dependencies from independent claims 1 and 25, which are believed patentable for at least the reasons identified above.

Furthermore, as discussed above with reference to independent claims 1, 25 and 38, in a response dated December 13, 2007, Appellants submitted a Declaration of Prior Invention in accordance with 37 CFR 1.131. The Declaration and the exhibits attached thereto evidence the actual reduction to practice of an invention falling within the present independent claims at least as early as March 12, 2001.

Appellants note that the Mobin reference was first published when issued on February 18, 2003, which is the effective date of Mobin *under §102(a)*, Appellants believe that the claims of the Mobin reference and the claims of the present application are neither directed to the same invention nor are obvious variants of one another. Accordingly, Appellants respectfully submit that the Declaration is effective to remove Mobin as *§102(a)* prior art.

In view of the Declaration, Appellants respectfully submit that Mobin qualifies as prior art only under *§102(e)*. Appellants note that both Mobin and the present application are currently assigned of record to Agere Systems Inc. ("Agere"). Furthermore, both Mobin and the claimed invention were subject to an obligation of assignment to Agere at the time the claimed invention was made. Accordingly, Appellants respectfully submit that, pursuant to 35 U.S.C. §103(c), Mobin may not be used in a rejection under 35 U.S.C. §103(a). See "35 USC § 103(c) & CREATE Act of 2004," available at http://www.uspto.gov/web/offices/dcom/olia/aipa/103cfaq.htm ("[I]f the reference is a U.S. patent or U.S. patent application publication which is prior art under 35 U.S.C. 102(a) and (e), applicant could swear behind the reference's publication date pursuant to 37 CFR 1.131 to

disqualify the reference as prior art under 35 U.S.C. 102(a), and then use 35 U.S.C. 103(c) to disqualify the reference").

Accordingly, Appellants maintain that the Declaration of Prior Invention filed December 13, 2007, and the Attorney Affidavit filed June 5, 2008, are effective to remove Mobin, as well as Tzannes, from consideration and thus to overcome the present rejection.

Claim 34

As noted above, Appellants maintain that the Declaration of Prior Invention filed December 13, 2007, and the Attorney Affidavit filed June 5, 2008, are effective to remove Tzannes and Mobin from consideration, and is hence sufficient to overcome the present rejection.

Moreover, Appellants respectfully submit that the references cited in the present rejections, when considered either individually or in combination, fail to teach or suggest every limitation of independent claim 34.

Independent claim 34 includes limitations directed toward generating at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal distinct from the received signal and representative of at least one characteristic of the wireless communication channel; and generating a signal quality estimate as a function of a difference between the at least one reference field and the at least one field in the received signal.

As discussed above with reference to independent claims 1, 25 and 38, the relied-upon portion of Sano fails to teach or suggest the claim limitation directed to generating a reference field based on a field of the received signal and on a channel estimation signal distinct from the received signal. Instead, Sano teaches away from this claim limitation by teaching the calculation of a channel estimate value using a field in the received signal (the common pilot portion), then carrying out a fading compensation on the received signal based on this channel estimate value.

The Examiner contends that Mobin at column 10, lines 22-32 teaches the claim limitation of "generating a signal quality estimate as a function of a difference between the at least one reference field and the at least one field in the received signal." The relied-upon portion of Mobin discloses calculating a branch metric "for each possible transition from one individual

state to the next individual state" as a Euclidean distance between "the components of each reconstructed signal sample" and "the components of the received signal sample." Even if this branch metric could be considered analogous to the recited difference, the relied-upon portion of Mobin fails to teach or suggest generating a signal quality estimate as a function of the branch metric. Indeed, rather than using the branch metric to generate a signal quality estimate, Mobin instead teaches away by disclosing a technique wherein a Viterbi decoder "employs this branch metric to determine the remaining paths," thereby determining which bit sequence is the most likely to have been transmitted. See Mobin at column 9, lines 46-63.

Appellants respectfully submit that Tzannes fails to supplement Sano and Mobin so as to teach or suggest at least the limitations discussed above. Accordingly, independent claim 34 is believed to be patentable over the proposed combination of references.

<u>3. Rejection of claims 7-9, 18-20, 23, 24 30, 31 and 37 under §103(a) over Sano, Tzannes, Mobin and Balachandran.</u>

<u>Claims 7-9, 30 and 31</u>

Dependent claims 7-9, 30 and 31 believed to be patentable at least by virtue of their respective dependencies from independent claims 1 and 25, which are believed patentable for at least the reasons identified above.

Moreover, as noted above, Appellants maintain that the Declaration of Prior Invention filed December 13, 2007, and the Attorney Affidavit filed June 5, 2008, are effective to remove Tzannes and Mobin from consideration, and are thus sufficient to overcome the present rejection.

<u>Claims 18-20 and 37</u>

As noted above, Appellants maintain that the Declaration of Prior Invention filed December 13, 2007, and the Attorney Affidavit filed June 5, 2008, are effective to remove Tzannes and Mobin from consideration, and are thus sufficient to overcome the present rejection.

Moreover, Appellants respectfully submit that the references cited in the present rejections, when considered either individually or in combination, fail to teach or suggest every limitations of independent claims 18 and 37.

Independent claims 18 and 37 are directed to a method and circuit, respectively, each of which contains similar limitations substantially directed toward "generating at least one

reference field based at least in part on the at least one field in the received signal and on a channel estimation signal . . . distinct from the received signal. . .; comparing the at least one field in the received signal with the at least one reference field and generating a difference signal corresponding thereto; [and] generating a signal quality estimate, the signal quality estimate being a function of the difference signal."

As discussed above with reference to independent claims 1, 25 and 38 the relied-upon portion of Sano fails to teach or suggest the claimed step of generating a reference field based on a field of the received signal and on a channel estimation signal distinct from the received signal. Instead, Sano teaches away from this claim limitation by teaching the calculation of a channel estimate value using a field in the received signal (the common pilot portion), then carrying out a fading compensation on the received signal based on this channel estimate value.

The Examiner contends that Mobin at column 10, lines 22-32 teaches the claim limitation of "generating a signal quality estimate, the signal quality estimate being a function of the difference signal." The relied-upon portion of Mobin discloses calculating a branch metric "for each possible transition from one individual state to the next individual state" as a Euclidean distance between "the components of each reconstructed signal sample" and "the components of the received signal sample." Even if this branch metric could be considered analogous to the recited difference signal, the relied-upon portion of Mobin fails to teach or suggest generating a signal quality estimate as a function of the branch metric. Indeed, rather than using the branch metric to generate a signal quality estimate, Mobin instead teaches away by disclosing a technique wherein a Viterbi decoder "employs this branch metric to determine the remaining paths," thereby determining which bit sequence is the most likely to have been transmitted. See Mobin at column 9, lines 46-63.

Appellants respectfully submit that Tzannes and Balachandran fails to supplement Sano so as to teach or suggest at least the limitations discussed above. Accordingly, independent claim 16 is believed to be patentable over the proposed combination of references.

Dependent claims 19 and 20 believed to be patentable at least by virtue of their dependency from independent claim 18, which is believed patentable for at least the reasons identified above.

4. Rejection of claims 10 and 32 under §103(a) over Sano, Tzannes, Mobin, and Li.

Dependent claims 10 and 32 believed to be patentable at least by virtue of their respective dependencies from independent claims 1 and 25, which are believed patentable for at least the reasons identified above.

Furthermore, as discussed above with reference to independent claims 1, 25 and 38, in a response dated December 13, 2007, Appellants submitted a Declaration of Prior Invention in accordance with 37 CFR 1.131. The Declaration and the exhibits attached thereto evidence the actual reduction to practice of an invention falling within the present independent claims at least as early as March 12, 2001.

5. Rejection of claim 11 under §103(a) over Sano, Tzannes, Li and Balachandran.

Dependent claim 11 is believed to be patentable at least by virtue of its dependency from independent claims 1 and 25, which are believed patentable for at least the reasons identified above.

Furthermore, as discussed above, in a response dated December 13, 2007, Appellants submitted a Declaration of Prior Invention in accordance with 37 CFR 1.131. The Declaration and the exhibits attached thereto evidence the actual reduction to practice of an invention falling within the present independent claims at least as early as March 12, 2001.

Appellants note that the Li reference has a filing date of February 20, 2002. Appellants respectfully submit that the claims of the Li reference and the claims of the present application are neither directed to the same invention nor are obvious variants of one another.

Accordingly, Appellants maintain that the Declaration of Prior Invention filed December 13, 2007, and the Attorney Affidavit filed June 5, 2008, are effective to remove Li, as well as Tzannes and Mobin, from consideration and thus to overcome the present rejection.

6. Rejection of claim 15 under §103(a) over Sano, Tzannes, and Balachandran.

Dependent claim 15 is believed to be patentable at least by virtue of its dependency from independent claim 1, which is believed patentable for at least the reasons identified above.

7. Rejection of claims 21 and 22 under §103(a) over Sano, Tzannes, Mobin, Balachandran, and Li.

Dependent claims 21 and 22 are believed to be patentable at least by virtue of their dependency from independent claim 18, which is believed patentable for at least the reasons identified above.

Moreover, as noted above, Appellants maintain that the Declaration of Prior Invention filed December 13, 2007, and the Attorney Affidavit filed June 5, 2008, are effective to remove Li, as well as Tzannes and Mobin, from consideration and thus to overcome the present rejection.

Furthermore, Appellants respectfully submit that there is insufficient objective motivation to combine the references cited by the Examiner, as well as a lack of reasonable expectation of success in doing so. Specifically, the Examiner appears to be engaging in hindsight-based piecemeal analysis.

See, e.g., *Princeton Biochemicals, Inc. v. Beckman Coulter, Inc.*, 411 F.3d 1332, 1337, 75 USPQ2d 1051, 1054 (Fed. Cir. 2005) ("[I]n making the assessment of differences between the prior art and the claimed subject matter, section 103 specifically requires consideration of the claimed invention 'as a whole.' . . . Without this important requirement, an obviousness assessment might successfully break an invention into its component parts, then find a prior art reference corresponding to each component. This line of reasoning would import hindsight into the obviousness determination by using the invention as a roadmap to find its prior art components."); *Ruiz v. A.B. Chance Co.*, 357 F.3d 1270, 1275, 69 USPQ2d 1686, 1690 (Fed. Cir. 2004) ("The 'as a whole' instruction in [35 U.S.C. §103(a)] prevents evaluation of the invention part by part. Without this important requirement, an obviousness assessment might break an invention into its component parts (A + B + C), then find a prior art reference containing A, another containing B, and another containing C, and on that basis alone declare the invention obvious. . . . Section 103 precludes this hindsight discounting of the value of new combinations by requiring assessment of the invention as a whole.")

See also *KSR Intern. Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (U.S., 2007) ("[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. . . . This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.")

8. Rejection of claim 36 under §103(a) over Sano, Tzannes, Mobin, Balachandran, and Shurvinton.

Dependent claim 35 is believed to be patentable at least by virtue of its dependency from independent claim 34, which is believed patentable for at least the reasons identified above.

Furthermore, as discussed above with reference to independent claims 1, 25 and 38, in a response dated December 13, 2007, Appellants submitted a Declaration of Prior Invention in accordance with 37 CFR 1.131. The Declaration and the exhibits attached thereto evidence the actual reduction to practice of an invention falling within the present independent claims at least as early as March 12, 2001.

Appellants further note that the Shurvinton reference has a priority date of March 7, 2002. Appellants respectfully submit that the claims of the Shurvinton reference and the claims of the present application are neither directed to the same invention nor are obvious variants of one another. Accordingly, Appellants respectfully submit that the Declaration is effective to remove Shurvinton as §102(e) prior art.

Accordingly, Appellants maintain that the Declaration of Prior Invention filed December 13, 2007, and the Attorney Affidavit filed June 5, 2008, are effective to remove Shurvinton, as well as Tzannes and Mobin and Li, from consideration and thus to overcome the present rejection.

Furthermore, Appellants respectfully submit that there is insufficient objective motivation to combine the references cited by the Examiner, as well as a lack of reasonable expectation of success in doing so. Specifically, the Examiner appears to be engaging in hindsight-based piecemeal analysis.

See, e.g., *Princeton Biochemicals, Inc. v. Beckman Coulter, Inc.*, 411 F.3d 1332, 1337, 75 USPQ2d 1051, 1054 (Fed. Cir. 2005) ("[I]n making the assessment of differences between the prior art and the claimed subject matter, section 103 specifically requires consideration of the claimed invention 'as a whole.' . . . Without this important requirement, an obviousness assessment might successfully break an invention into its component parts, then find a prior art reference corresponding to each component. This line of reasoning would import hindsight into the obviousness determination by using the invention as a roadmap to find its prior art components."); *Ruiz v. A.B. Chance Co.*, 357 F.3d 1270, 1275, 69 USPQ2d 1686, 1690 (Fed.

Cir. 2004) ("The 'as a whole' instruction in [35 U.S.C. §103(a)] prevents evaluation of the invention part by part. Without this important requirement, an obviousness assessment might break an invention into its component parts (A + B + C), then find a prior art reference containing A, another containing B, and another containing C, and on that basis alone declare the invention obvious. . . . Section 103 precludes this hindsight discounting of the value of new combinations by requiring assessment of the invention as a whole.")

See also *KSR Intern. Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (U.S., 2007) ("[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. . . . This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.")

In view of the foregoing, claims 1-38 are believed to be in condition for allowance, and such favorable action is respectfully solicited.

Respectfully submitted,

/ wayne l. ellenbogen /

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Wayne L. Ellenbogen
Attorney for Applicant(s)
Reg. No. 43,602
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
(516) 759-7662

CLAIMS APPENDIX

1. In a wireless system comprising a wireless communication channel, a method for estimating a signal quality of a received signal, the method comprising the steps of:

receiving a signal from the wireless communication channel, the received signal comprising at least one field that is modulated and encoded in a substantially fixed manner;

generating at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal, the channel estimation signal being distinct from the received signal and representative of at least one characteristic of the wireless communication channel; and

generating a signal quality estimate as a function of the at least one field in the received signal and the generated at least one reference field.

2. The method of claim 1, wherein the step of generating the signal quality estimate comprises measuring a difference between one or more constellation points associated with the at least one reference field and one or more corresponding constellation points associated with the at least one field in the received signal.

3. The method of claim 2, wherein the measured difference comprises a Euclidean distance.

4. The method of claim 2, wherein the step of generating the signal quality estimate comprises the steps of:

aligning the one or more constellation points associated with the at least one field in the

received signal with the one or more corresponding constellation points associated with the at least one reference field; and

generating difference signals for each of at least a portion of samples in the at least one field in the received signal, each of the difference signals being representative of a difference between the at least one field in the received signal and the corresponding at least one reference field.

5. The method of claim 1, further comprising the step of delaying the at least one field in the received signal by an amount substantially equal to a latency associated with generating the at least one reference field.

6. The method of claim 1, further comprising the steps of:

generating a difference signal representative of a difference between the at least one field in the received signal and the at least one reference field; and

determining a magnitude of the difference signal, the signal quality estimate being a function of the magnitude of the difference signal.

7. The method of claim 6, further comprising the step of averaging at least a portion of magnitudes of difference signals corresponding to a plurality of samples in the at least one field in the received signal, each of the difference signals being representative of a difference between the at least one field in the received signal and the at least one reference field for a given one of the samples, the signal quality estimate being a function of the averaged magnitudes.

8. The method of claim 7, wherein the averaging step comprises adding a magnitude value corresponding to a present sample in the at least one field in the received signal to a magnitude value corresponding to a previous sample in the at least one field in the received signal.

9. The method of claim 7, wherein the number of samples in the at least one field in the received signal is 48.

10. The method of claim 1, further comprising the steps of:

generating a difference signal representative of a difference between the at least one field in the received signal and the at least one reference field; and

measuring a power of the difference signal, the signal quality estimate being a function of at least the power measurement of the difference signal.

11. The method of claim 10, further comprising the step of averaging at least a portion of power measurements of difference signals corresponding to a plurality of samples in the at least one field in the received signal, the signal quality estimate being a function of the averaged power measurements.

12. The method of claim 1, wherein at least a portion of the received signal is organized as an Institute of Electrical and Electronics Engineers (IEEE) standard 802.11 frame, the at least one field in the received signal comprising a SIGNAL field in the IEEE 802.11 frame.

13. The method of claim 1, wherein the channel estimation signal is obtained at least prior to generating the at least one reference field.

14. The method of claim 1, wherein the received signal comprises at least one training symbol and the channel estimation signal is computed based at least in part on the at least one training symbol in the received signal.

15. The method of claim 1, wherein the received signal comprises a second field having a variable modulation and encoding, the method further comprising the step of changing at least one of the modulation and the encoding of the second field based, at least in part, on the signal quality estimate.

16. In a wireless system comprising a wireless communication channel, a method for estimating a signal quality of a received signal, the method comprising the steps of:

receiving a signal from the wireless communication channel, the received signal comprising at least one field that is modulated and encoded in a substantially fixed manner;

measuring at least one characteristic corresponding to the at least one field in the received signal; and

generating a signal quality estimate as a function of the at least one characteristic corresponding to the at least one field in the received signal.

17. The method of claim 16, wherein the at least one characteristic comprises at least one of signal-to-noise ratio, bit error rate, cyclic redundancy code, and checksum of the at least one field in the received signal.

18. In a wireless system comprising at least one transceiver configurable for communicating over a wireless communication channel, the transceiver comprising a transmitter and a receiver, a method for controlling a data transmission rate of the at least one transceiver, the method comprising the steps of:

receiving a signal from the wireless communication channel, the received signal comprising at least one field that is modulated and encoded in a substantially fixed manner;

generating at least one reference field based at least in part on the at least one field in the received signal and on a channel estimation signal, the channel estimation signal being distinct from the received signal and representative of at least one characteristic of the wireless communication channel;

comparing the at least one field in the received signal with the at least one reference field and generating a difference signal corresponding thereto;

generating a signal quality estimate, the signal quality estimate being a function of the difference signal; and

modifying the data transmission rate of the transmitter based, at least in part, on the signal quality estimate.

19. The method of claim 18, wherein the comparing step comprises measuring a difference between one or more constellation points associated with the at least one reference

field and one or more corresponding constellation points associated with the at least one field in the received signal.

20. The method of claim 19, wherein the comparing step comprises the steps of:

aligning the one or more constellation points associated with the at least one field in the received signal with the one or more corresponding constellation points associated with the at least one reference field; and

generating difference signals for each of at least a portion of samples in the at least one field in the received signal.

21. The method of claim 18, further comprising the step of measuring a power of the difference signal, the signal quality estimate being a function of the power measurement of the difference signal.

22. The method of claim 21, further comprising the step of averaging at least a portion of power measurements of difference signals corresponding to a plurality of samples in the at least one field in the received signal, the signal quality estimate being a function of the averaged power measurements.

23. In a wireless system comprising at least one transceiver configurable for communicating over a wireless communication channel, the transceiver comprising a transmitter and a receiver, a method for controlling a data transmission rate of the at least one transceiver, the method comprising the steps of:

receiving a signal from the wireless communication channel, the received signal comprising a first field that is modulated and encoded in a substantially fixed manner and a second field having a variable modulation and encoding;

measuring at least one characteristic corresponding to the first field in the received signal;

generating a signal quality estimate as a function of a difference between the at least one characteristic corresponding to the first field in the received signal and at least one threshold corresponding to the at least one characteristic; and

modifying at least one of the modulation and the encoding of the second field based, at least in part, on the signal quality estimate.

24. The method of claim 23, wherein the at least one characteristic comprises at least one of signal-to-noise ratio, bit error rate, cyclic redundancy code, and checksum of the first field in the received signal.

25. A circuit for estimating a signal quality of a signal received from a wireless communication channel, the received signal comprising at least one field that is modulated and encoded in a substantially fixed manner, the circuit comprising:

at least one controller, the at least one controller being operative: (i) to generate at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal, the channel estimation signal being distinct from the received signal and representative of at least one characteristic of the wireless communication channel; and (ii) to generate a signal quality estimate as a function of the at least one field in the received signal and the generated at least one reference field.

26. The circuit of claim 25, wherein the at least one controller is further operative to generate the signal quality estimate by measuring a difference between one or more constellation points associated with the at least one reference field and one or more corresponding constellation points associated with the at least one field in the received signal.

27. The circuit of claim 26, wherein the at least one controller is further operative: (iii) to align the one or more constellation points associated with the at least one field in the received signal with the one or more corresponding constellation points associated with the at least one reference field; and (iv) to generate difference signals for each of at least a portion of samples in the at least one field in the received signal, each of the difference signals being representative of a difference between the at least one field in the received signal and the at least one reference field for a given one of the samples.

28. The circuit of claim 25, wherein the at least one controller is further operative to delay the at least one field in the received signal by an amount substantially equal to a latency associated with generating the at least one reference field.

29. The circuit of claim 25, wherein the at least one controller is further operative: (iii) to generate a difference signal representative of a difference between the at least one field in the received signal and the at least one reference field; and (iv) determine a magnitude of the difference signal, the signal quality estimate being a function of the magnitude of the difference signal.

30. The circuit of claim 29, wherein the at least one controller is further operative to average at least a portion of magnitudes of difference signals corresponding to a plurality of samples in the at least one field in the received signal, the signal quality estimate being a function of the averaged magnitudes.

31. The circuit of claim 30, wherein the step of averaging at least a portion of magnitudes of difference signals comprises adding a magnitude value corresponding to a present sample in the at least one field in the received signal to a magnitude value corresponding to a previous sample in the at least one field in the received signal.

32. The circuit of claim 25, wherein the at least one controller is further operative: (iii) to generate a difference signal representative of a difference between the at least one field in the received signal and the at least one reference field; and (iv) to measure a power of the difference signal, the signal quality estimate being a function of at least the measured power of the difference signal.

33. The circuit of claim 25, wherein the channel estimation signal is obtained at least prior to generating the at least one reference field.

34. A circuit for estimating a signal quality of a signal received from a wireless communication channel, the received signal comprising at least one field that is modulated and encoded in a substantially fixed manner, the circuit comprising:

a processor operative to generate at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal, the channel estimation signal being distinct from the received signal and representative of at least one characteristic of the wireless communication channel; and

a comparator coupled to the processor, the comparator being configurable for generating a signal quality estimate as a function of a difference between the at least one reference field and the at least one field in the received signal.

35. A circuit for estimating a signal quality of a signal received from a wireless communication channel, the received signal comprising at least one field that is modulated and encoded in a substantially fixed manner, the circuit comprising:

a processor operative to generate at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal, the channel estimation signal being representative of at least one characteristic of the wireless communication channel; and

a comparator coupled to the processor, the comparator being configurable for generating a signal quality estimate as a function of a difference between the at least one reference field and the at least one field in the received signal;

wherein the processor comprises:

a slicer configurable for receiving the at least one field in the received signal and recovering therefrom a plurality of received symbol bits associated with the at least one field;

a decoder configurable for correcting one or more errors potentially present in the received symbol bits, the corrected received symbol bits corresponding to originally transmitted

symbol bits in the at least one field;

an encoder configurable for encoding the corrected received symbol bits;

a modulator configurable for converting the encoded corrected received symbol bits to a baseband signal; and

a multiplier configurable for combining the baseband signal and the channel estimation signal and generating the at least one reference field based at least in part on the baseband signal and on the channel estimation signal.

36. The circuit of claim 34, further comprising an integrator coupled to the comparator, the integrator being configurable for averaging at least a portion of magnitudes of difference signals corresponding to a plurality of samples in the at least one field in the received signal, each of the difference signals being representative of a difference between the at least one field in the received signal and the at least one reference field for a given one of the samples, the signal quality estimate being a function of the averaged magnitudes.

37. A circuit for selectively adapting a data transmission rate of a wireless communication system, the wireless communication system comprising a transceiver configurable for communication over a wireless communication channel, the transceiver comprising a receiver and a transmitter, the circuit comprising:

at least one controller, the at least one controller being operative: (i) to receive a signal from the wireless communication channel, the received signal comprising at least one field that is modulated and encoded in a substantially fixed manner; (ii) to generate at least one reference field based at least in part on the at least one field and on a channel estimation signal,

the channel estimation signal being distinct from the received signal and representative of at least one characteristic of the wireless communication channel; (iii) to compare the at least one field in the received signal with the at least one reference field and to generate a difference signal corresponding thereto; (iv) to generate a signal quality estimate, the signal quality estimate being a function of the difference signal; and (v) to modify the data transmission rate of the transmitter based, at least in part, on the signal quality estimate.

38. A semiconductor device including at least one circuit for estimating a signal quality of a signal received from a wireless communication channel, the received signal comprising at least one field that is modulated and encoded in a substantially fixed manner, the at least one circuit comprising:

at least one controller, the at least one controller being operative: (i) to generate at least one reference field based, at least in part, on the at least one field in the received signal and on a channel estimation signal, the channel estimation signal being distinct from the received signal and representative of at least one characteristic of the wireless communication channel; and (ii) to generate a signal quality estimate as a function of the at least one field in the received signal and the generated at least one reference field.

EVIDENCE APPENDIX

Attached hereto is a Declaration of Prior Invention Under 37 C.F.R. §1.131 and accompanying Exhibit 1, originally submitted on December 13, 2007, and an Attorney Affidavit and accompanying Exhibits 1-7, originally submitted on June 5, 2008.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicants: J. Boer et al.
Case: 6-2-2-5
Serial No.: 10/621,862
Filing Date: July 17, 2003
Art Unit: 2611
Examiner: Leila Malek

Title: Signal Quality Estimation in a Wireless Communication System

DECLARATION OF PRIOR INVENTION UNDER 37 C.F.R. §1.131

We, the undersigned, hereby declare and state as follows:

1. We are named joint inventors of the invention that is the subject of the above-referenced U.S. patent application. We have assigned our respective interests in the patent application to Agere Systems Inc. ("Agere").

2. The invention falling within the scope of the claims in the present application was conceived and reduced to practice at some time prior to March 12, 2001.

3. On or about March 12, 2001, an Agere proprietary document ("Agere Systems ASIC Team Design Note No. WADN129, Rev. C") describing the invention was prepared by inventor Bas Driesen. A copy of this document is attached hereto as Exhibit 1.

4. The document attached hereto as Exhibit 1 demonstrates an actual reduction to practice of the invention in the form of results obtained from a simulation comprising an embodiment of an invention falling within the scope of the claims in the present application. These results are included in this document and labeled as Section 5 and Appendices A and B of this document.

5. All statements made herein of our own knowledge are true, and all statements made on information and belief are believed to be true.

6. We understand that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001, and may jeopardize the validity of the application or any patent issuing thereon.

Date: 21-Nov-2007

Jan Boer

Date: ____________

Bas Driesen

Date: ____________

Ra'anan Gil

Date: 21-Nov-2007

Kai Roland Kriedte

5. All statements made herein of our own knowledge are true, and all statements made on information and belief are believed to be true.

6. We understand that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001, and may jeopardize the validity of the application or any patent issuing thereon.

Date: ____________ ______________________________
Jan Boer

Date: 22-11-07 ______________________________
Bas Driesen

Date: ____________ ______________________________
Ra'anan Gil

Date: ____________ ______________________________
Kai Roland Kriedte

EXHIBIT 1

agere systems	ASIC Team Design Note

No: WADN129 Rev: C	Author: Bas Driesen Date: March 12, 2001
Subject : **OFDM Signal Quality Indicator**	

1. ABSTRACT

This design note describes a preposition for a Signal Quality (SQ) indicator for the OFDM base band processor.

2. CHANGES

- Better description of the performed simulations and the results/figures.
- Signal degradation values recalculated, with respect to the resolution bandwidth.
- Additional simulation performed concerning the relation between the signal degradation and the erroneous packets.
- Included a paragraph about the system related aspects.

3. INTRODUCTION

A Signal Quality (SQ) estimation of the received base band signal can be useful for adapting the rate of the link. This design note presents an algorithm for a SQ indicator and provides simulation results on it.

Rate adaptation takes place inside the transmitter at MAC-level. Until now adapting the rate solely relied on the information acquired through the acknowledgement messages received after each well-transmitted packet, thus an acknowledgement message indicates a correctly received packet. Changing the rate of the link depends on the number of good or bad transmitted/received packages. When two packets in a row are received with errors the rate is switched one rate down, to the transmitter the absence of an acknowledgement message is seen as an error. In practice it appeared that switching the rate down happened to fast and this was found to be especially the case in high-density areas. Due to the higher probability of collision between the different stations, more often an acknowledgement message is missed. At the transmitter side this would imply a receive error. After two such receive errors the transmitter will, according to the algorithm switch down a rate. However errors occurred as a result of a collisions are not dedicated to worsening channel or receive situations. In this case the transmitter should not go down a rate. Increasing the rate is done when 5 packages are received in good order, this need not to be 5 consecutive packages. After receiving 5 packets well the transmitter tries to send once at a rate higher. A positive acknowledgement leads to sticking at this higher rate and the absence of an acknowledgement leads to keeping the lower rate. The same procedure

will then repeat itself. Furthermore it is good to know that the access point will follow the station when switching to a higher rate.

To be able to switch faster, more reliable and in bigger steps between the different rates it is necessary to have a more sophisticated rate-switching algorithm. A way to achieve this is by having a representative signal quality indication at disposal. This signal quality needs to be extracted at the receiver and should be made available at the transmitter, as the transmitter has to set the rate. The receiver can measure the signal quality by processing the incoming messages that can either be payload messages or acknowledgement messages. When assuming quasi-static symmetric channel transfer characteristics and transceiver impairments these messages undergo the same degradation as the actual data sent, and thus will be equal in quality. This will be the starting point of the following outline.

4. ALGORITHM OUTLINE

The idea behind the SQ indicator is measuring the Euclidean distance between the reference constellation points and the received constellation points. The closer the received constellation points are to the reference constellation points the better SQ. For rate independent processing and for the sake of simplicity only the SIGNAL-field of a message is used for the SQ measurement. The SIGNAL-field consists of 24 bits that are rate ½ coded and BPSK modulated, resulting in 48 samples located at +1 or –1 [1].

A first draft implementation of a Signal Quality (SQ) indicator or better a Signal Degradation (SD) indicator in SPW looked like Figure 1. This implementation first scales the incoming samples according to the amplitude estimate of the channel and the power droop to position them around the reference points. The scaled samples are then compared with the reference samples of +1 and –1. The magnitude of the resulting error is then computed and only the path that has the smallest magnitude is forwarded. This leads to 48 magnitude values, summing them results in a number representing the SD.

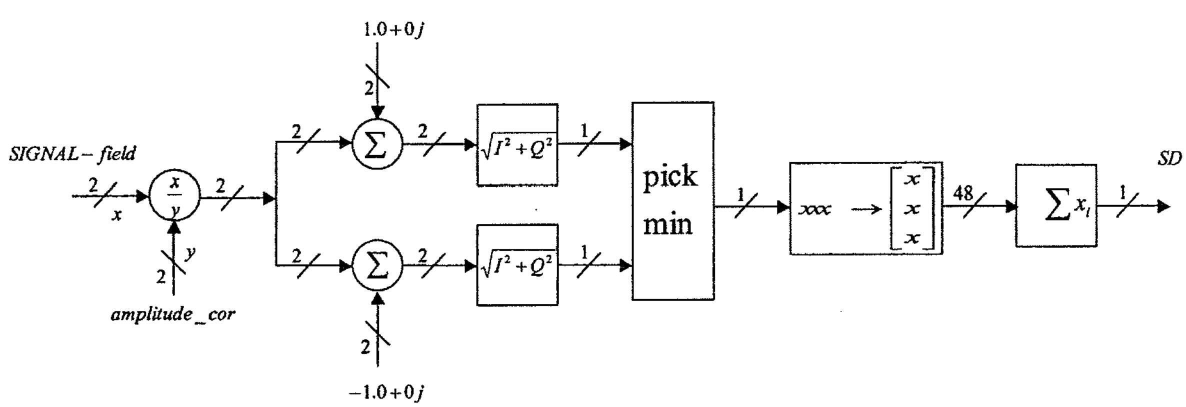


Figure 1: SPW implementation of the Signal Quality indicator

Figure 2 represents a second implementation that is more ASIC friendly. As can be seen this implementation does not use a divide operation and has one path instead of two paths. The summing operation at the end is now implemented as an integrator that

is reset after each SIGNAL-field. A first simplification is mapping all samples to the positive half plane by taking the absolute value of the real part of the incoming samples. This simplification is justified because comparing a sample in the negative half plane with the negative reference point is the same in sense of magnitude as comparing a mirrored version of this sample with the positive reference point. Then instead of comparing the samples with +1 or –1, which needs scaling in front, the incoming samples are compared with the amplitude reference for that specific sub carrier. Further reduction of processing complexity could be achieved when the magnitude is approached by a first order estimate or when instead the power is computed.

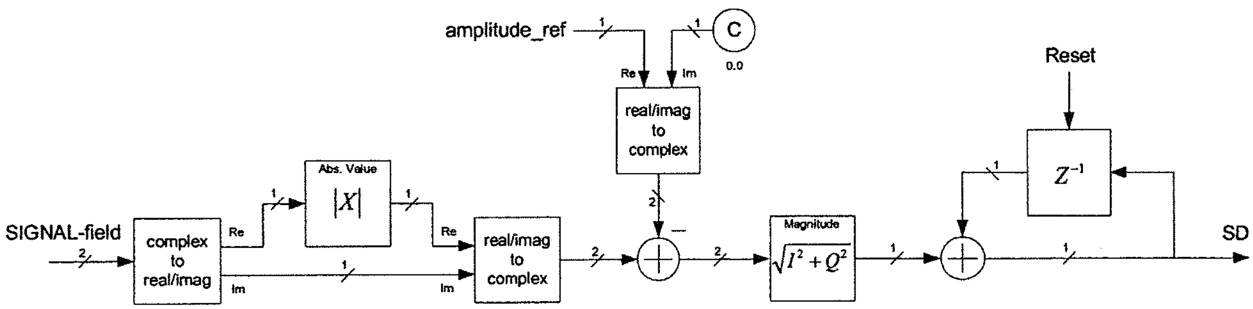


Figure 2: ASIC friendly SPW implementation of the Signal Quality indicator

A different approach would be processing the SIGNAL-field samples as well as the pilot samples. The pilot samples are namely BPSK modulated too and can therefore be processed in the same way as the SIGNAL-field samples. The advantage of this approach would be that the SD is determined using more than only the 48 samples of the SIGNAL-field and therefore maybe resulting in a better estimate of the SD of the packet. However the pilots are always spaced the same in frequency domain, consequently the SD they represent is only related to those specific frequencies, whereas the SD computed using all frequencies can deviate from this, because of frequency selective fading. For this reason a SD indicator based on the pilots is not of use.

5. SIMULATION RESULTS

The simulations performed in this Chapter make use of the first presented SPW implementation scheme. The changes made in the ASIC friendly implementation will lead to somewhat different simulation values, but the conclusions derived in this Chapter will still be valid.

The SD indicator is placed in the level-3 simulation environment at the receiver side behind the *level3mp_pilot_removal_proc_sw2* block. At this point the signal consist of the SIGNAL-field samples and the data samples, the pilot samples are already removed.

The first simulation is done in order to find for specific SNR's and TDS's the corresponding reference/mean SD-values. The simulation is carried out over 200 packets (of which the length is not of interest at this point, so it is chosen as small as possible to speed up the simulations) for a number of SNR's (6, 8, 10, 12, 14, 16, 18,

20, 22, 24, 26, 28, 30) and TDS's (0ns, 50ns, 100ns). The SIGNAL-field of each packet is processed accordingly to the scheme in Figure 1. This will result in 200 different SD-values. The reference/mean SD-values are computed by averaging these 200 SD-values. Figure 3 depicts the reference SD-values/curves for the mentioned range of SNR and TDS values, the corresponding values can be found in Table 2 Appendix A. It can be seen that there is a 2 dB difference in SNR between the 0ns TDS and the 100ns TDS curve for an SD of 5. This means that a system not suffering from TDS can handle about 2 dB more SNR than a system suffering from 100ns TDS, both resulting in the same SD. The difference in SNR between a TDS of 50ns and a TDS of 100ns is about 0.5 dB for an SD of 5, which can be considered as marginal. Furthermore the figure shows that the difference slightly increases for lower SD and slightly decreases for higher SD, which means that at high SD or low SNR the TDS puts less weight to the actual SD, while at low SD or high SNR the TDS puts more weight to the actual SD.

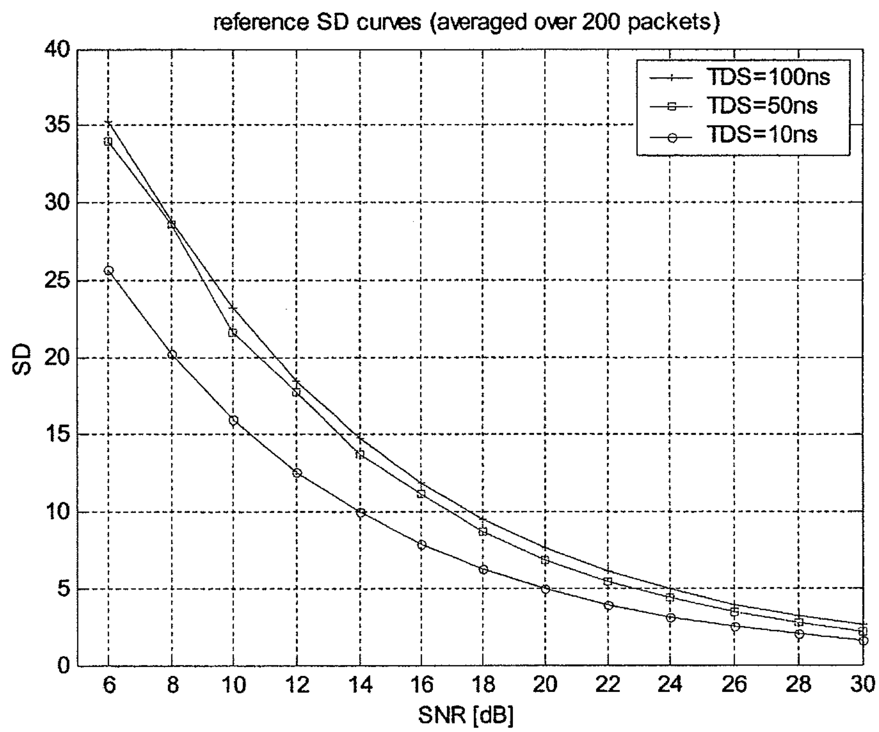


Figure 3: Reference SD curves using 200 packets per SNR and TDS

Ideally the SD of the SIGNAL-field would perfectly match the SD of the total packet. However normally the SIGNAL-field SD cannot represent the SD of the total packet, because the SIGNAL-field SD represents just a small part of the total packet.

A second simulation is done in order to see with what kind of accuracy the SIGNAL-field represents the total packet, which will proof the usefulness of the SQ/SD indicator. The simulation considered is done over 100 60-bytes BPSK modulated packets, which gives 21 payload symbols. When each payload symbol is processed in the same way as the SIGNAL-field symbol, then this results after averaging over the symbols in a SD-value for the total packet. The total length of a packet in samples is `(21 payload symbols + 1 SIGNAL-field symbol) * 48 = 1056 samples`. This number is chosen in such a way that increasing the number does not provide much

more information, this is true because of the fact that a static channel per packet is assumed.

From the simulations it follows that the distribution of the SIGNAL-field SD compared to the total packet SD can be approached by a normal distribution function. A property of the PDF of a normal distribution function is that 95% of its samples lie within μ-2σ and μ+2σ, where μ stands for the mean and σ for the standard deviation. The mean μ equals zero for every SNR and TDS, but the standard deviation σ is different. For a specific SNR and TDS there exists a SD reference value and for that same SNR and TDS there exists a standard deviation σ between the SIGNAL-field SD and the total packet SD. Since the mean μ equals zero the standard deviation σ can be directly mapped to the SD reference values. Figure 4 depicts the SD reference values $\pm 2\sigma$ for simulations with a TDS of 100ns and SNR of 6, 10, 14, 18, 22, 26 and 30 dB. In Table 3 of Appendix A the computed variance σ^2 is given for a TDS of 100ns and certain SNR, from this the standard deviation σ can be derived. The $\pm 2\sigma$ boundaries for a specific reference SD can be linked to the SNR axis. The resolution of the SD is defined as the difference in SNR between the boundaries $\pm 2\sigma$. From this figure it can be seen that the different SD-distribution regions denoted with different colors overlap, which means that the resolution of the SD in this case is more than 4 dB SNR. Furthermore Figure 4 shows that the resolution for higher SD is worse than the resolution for lower SD, for low SD the resolution approaches the 4 dB SNR.

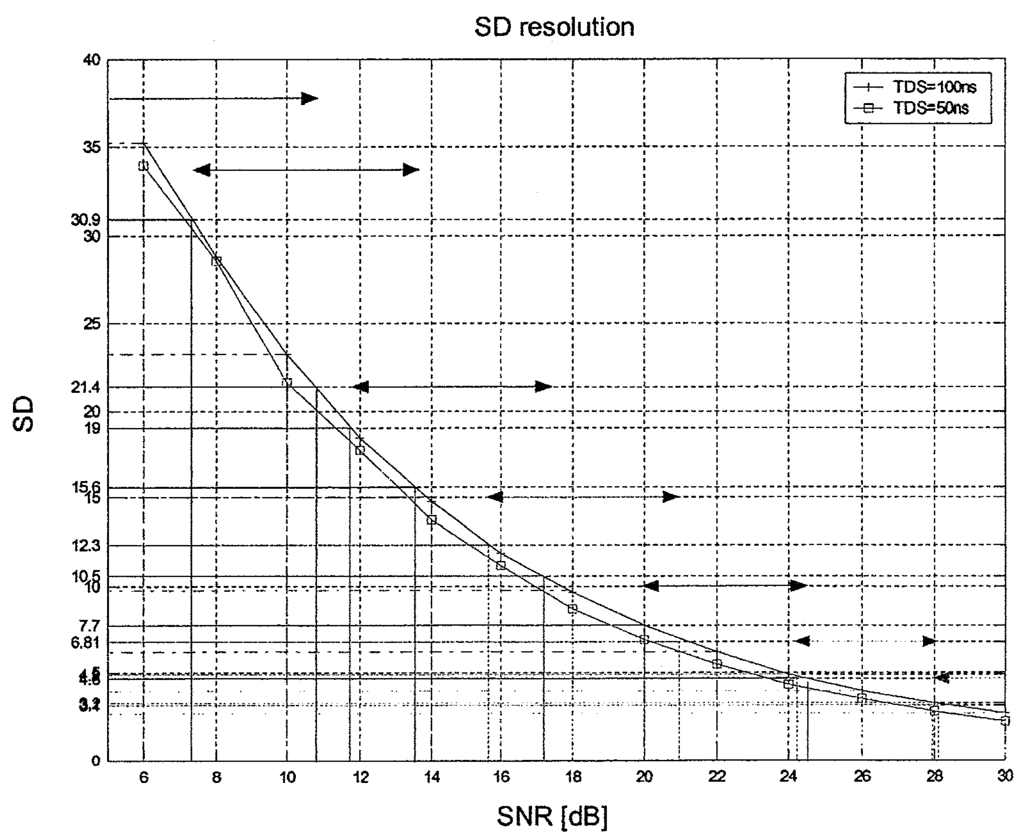


Figure 4: SD deviation, simulated for 100ns TDS and 6, 10, 14, 18, 22, 26, 30 dB SNR

Interpretation of the simulation results requires the SD to be linked to the system performance (PER) curves. Figure 5 depicts the system performance curves at different rates in a fading channel with a TDS of 50 ns. From this figure it shows that for a minimum PER of 5% at a rate of 54 Mb/s the SNR should be greater or equal to 26.5 dB. In Figure 3 an SNR of 26.5 dB for a TDS of 50 ns corresponds to a reference SD of 3.4. Meaning that on the average an SD of 3.4 will give a 5% PER for the rate of 54 Mb/s. Now lets make the assumption that an SD of 3.4 results in 5% PER at 54 Mb/s, which implies that a measured SD of 3.4 or lower is sufficient to achieve at least a 5% PER for that specific rate. However as shown earlier the measured SD will differ from the total packet SD, so a safety margin would be in place here. In the former a resolution bandwidth is determined, which specifies the deviation between the SD of the SIGNAL-field and the total packet. Simulations pointed out that the resolution is worse for higher TDS. The resolution results for the SD at 100 ns TDS can thus be seen as a worst-case scenario for the resolution of lower TDS SD curves. Adding half of the resolution bandwidth to the SNR that leads to a 5% PER for a specific rate results in an SD value of which can be said that it gives at maximum a 5% PER with certainty of 97.5%. Subtracting half of the resolution bandwidth leads to an SD value of which can be said that it gives at minimum a 5% PER with a certainty of 97.5%. As a matter of fact these two derived SD values can be seen as the lower and upper threshold levels for this specific rate. Column 4 and 5 of Table 1 give the lower and upper threshold values for the specified rates. Additionally gives a graphical representation of the lower and upper threshold levels for the different rates.

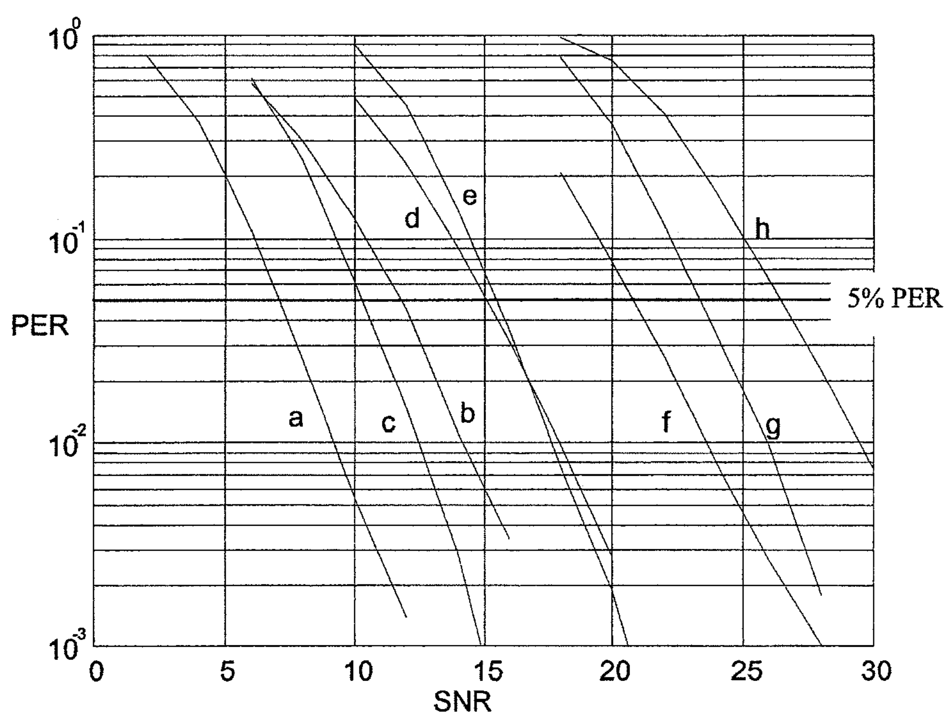


Figure 5: PER versus input SNR for 1000 byte packets in a fading channel with 50 ns delay spread and data rates of (a) 6, (b) 9, (c) 12, (d) 18, (e) 24, (f) 36, (g) 48, and (h) 54 Mbps.

Table 1: Lower and upper threshold SD levels for the different rates for a 50 ns TDS at 5 % PER.

Rates [Mb/s]	SNR at 5% PER [dB]	Resolution [dB]	Low T	Up T
54	26.5	4.0	2.6	4.2
48	24.5	4.5	3.3	5.3
36	20.75	5.0	4.8	8.4
24	15.5	5.5	8.5	16.0
12	10.25	6.0	15.2	30.0
6	7	8.0	19.6	--

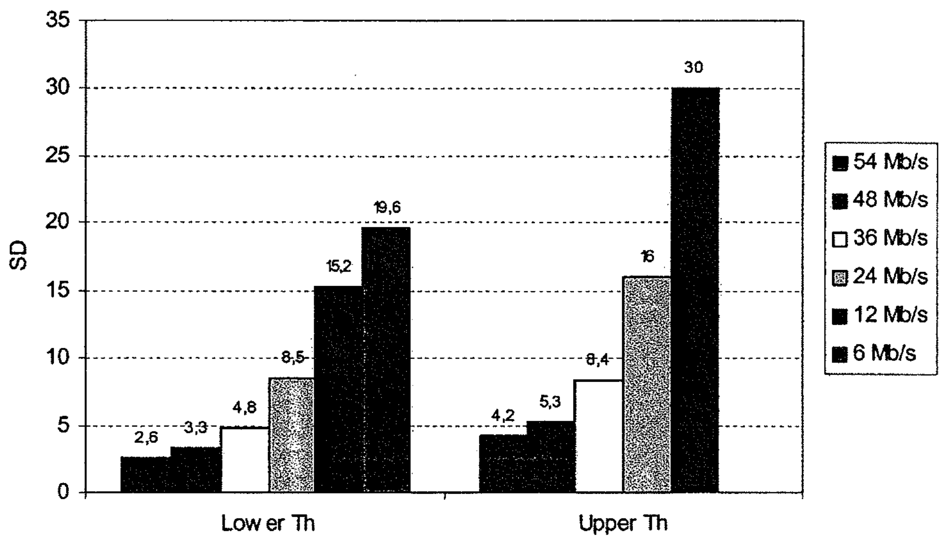


Figure 6: Graphical representation of lower and upper threshold SD levels

Appendix B shows the measured SD values and packet errors for an SNR of 20.75 dB respectively 26.5 dB and a TDS of 50 ns at 36 Mb/s, respectively 54 Mb/s. In these figures the red vertical lines identify SD values corresponding to an error. Furthermore the threshold levels belonging to the specific rate are depicted, the lower threshold level is colored pink and the upper threshold level black. Moreover the green line represents the reference/mean SD value. From these figures the usefulness of the SD indicator comes clearly forward.

A sophisticated rate-switching algorithm could now use the following mechanism. Up switching should be done as soon as the measured SD goes below the lower threshold level of a corresponding rate, however the inverse situation should not lead to a fallback in rate. The fallback mechanism should still rely on the error occurrence, but it might use the past SD information. For example a lower rate could be switched when two errors in a row occur and when a yet to be defined number of past SD values are above the upper threshold level. This method assumes that there does not occur a rapid SD change. So when two errors in a row are received but the past SD values are underneath the upper threshold for that specific rate the transmitter might choose to keep the same rate operable. In such a situation the errors could be attributed to collisions instead of worsening channel conditions. Figure 7 depicts a

state diagram of the proposed rate-switching algorithm. To overcome deadlock the rate should be switched down whenever lets say 5 errors in a row occur.

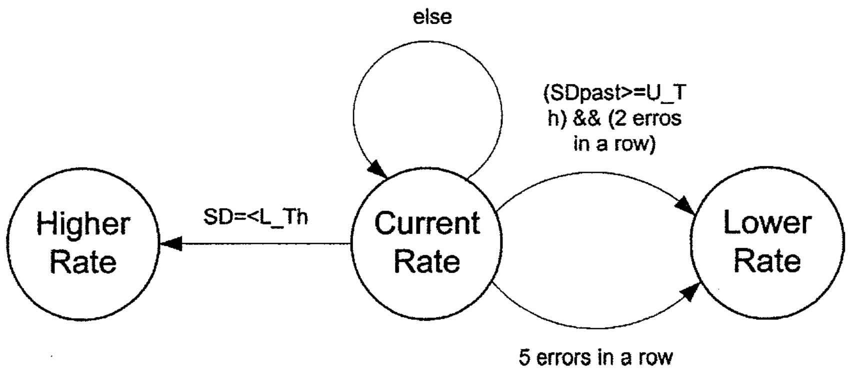


Figure 7: State diagram of possible rate switching algorithm

Simulations where the measured SD value is averaged over more than one packet are also performed. The result is that the lower and upper threshold levels are closer together, which makes it easier to distinct between the different rates at the expense of slower rate switching. However one needs to be careful with averaging over more than one packet, because the time in between packets can be large and in the meanwhile the channel conditions can be changed drastically.

6. CONCLUSIONS

From the simulations it follows that a decision can be made for rate switching on the basis of the measured SD value. A less stringent definition of the SD resolution results in relaxation of threshold levels, but this of course leads to less reliable rate estimation for this specific criterion of 5% PER. A second way of relaxing the threshold levels is to adopt a less stringent criterion, so for example tolerating a PER of 10% instead of 5%.

Implementation of the SQ/SD indicator as in Figure 2 leads to different threshold levels with respect to the threshold levels derived above, because of the fact that the outcome of the implementation differs slightly. However the above analyses still holds.

7. REFERENCES

[1] IEEE Std 802.11a-1999, "High-Speed Physical Layer in the 5 GHz Band", 16 Sept 1999.

APPENDIX A: SIMULATION RESULTS

Table 2: SD reference values calculated over 200 packets for different TDS and SNR

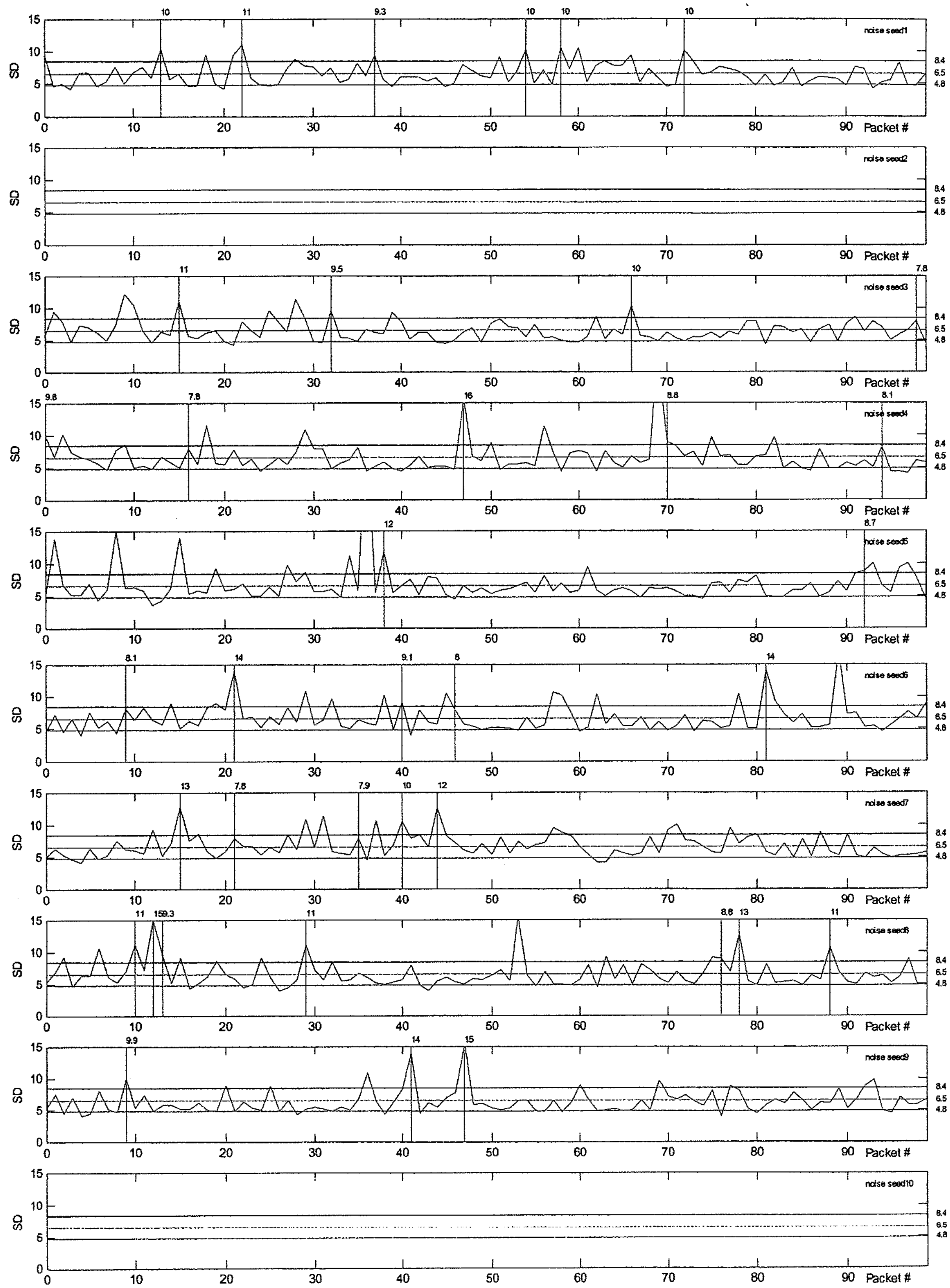
TDS	SNR	Reference SD values	TDS	SNR	Reference SD values	TDS	SNR	Reference SD values
0	6	25,705	50	6	33,96	100	6	35,23
	8	20,13		8	28,545		8	28,8
	10	15,925		10	21,63		10	23,215
	12	12,6		12	17,7		12	18,38
	14	9,985		14	13,695		14	14,755
	16	7,94		16	11,13		16	11,87
	18	6,29		18	8,665		18	9,55
	20	4,99		20	6,86		20	7,71
	22	3,965		22	5,465		22	6,155
	24	X		24	4,35		24	4,92
	26	2,5		26	3,46		26	3,975
	28	1,99		28	2,75		28	3,23
	30	1,58		30	2,185		30	2,635

Table 3: Variance between the packet SD and the SIGNAL-field SD for different averaging

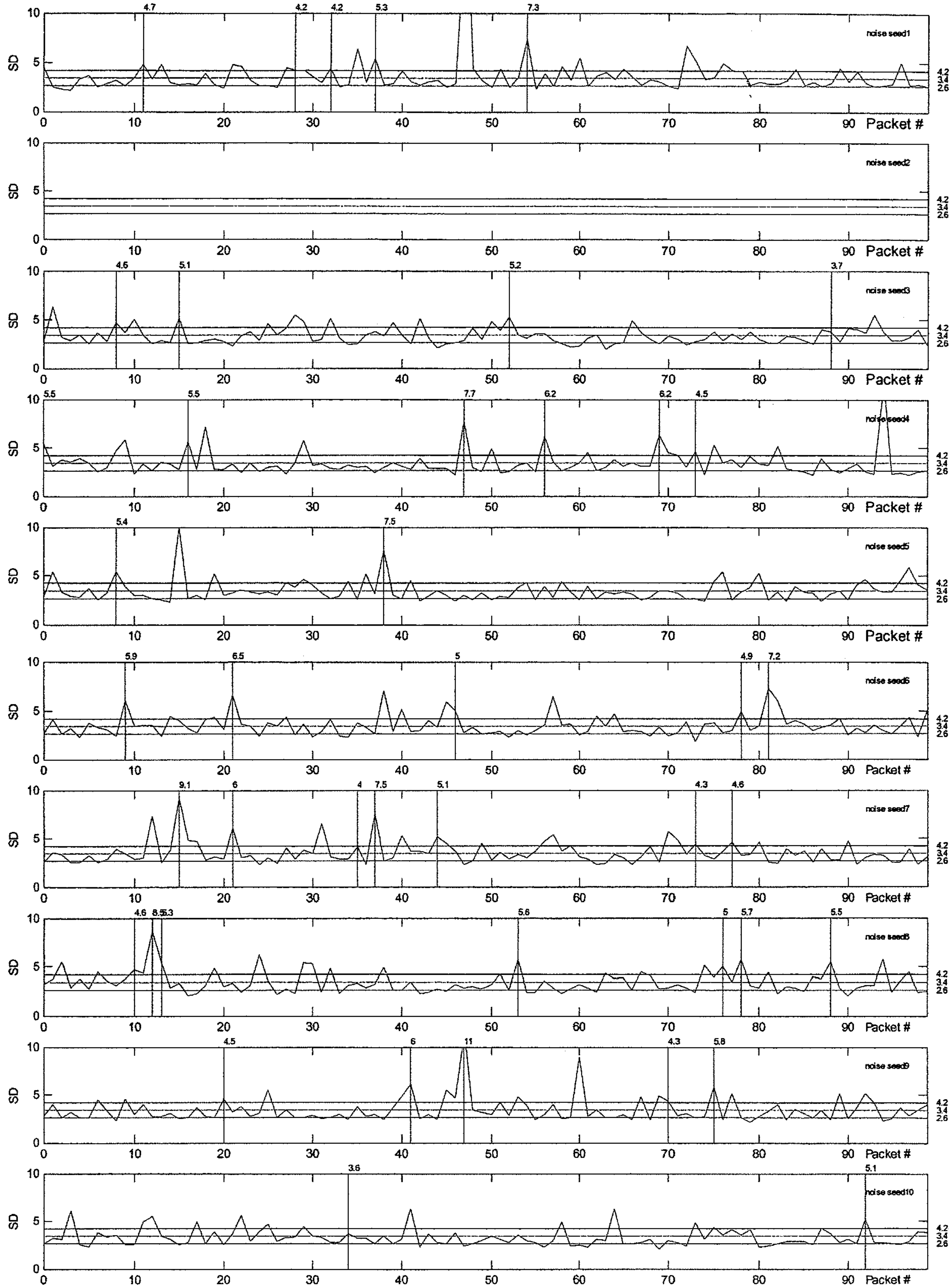
SNR	Reference SD (TDS=100ns)	var(SD_packet-SD_SIGNAL)	var(SD_packet_sliding2-SD_SIGNAL_sliding2)	var(SD_packet_sliding4-SD_SIGNAL_sliding4)	var(SD_packet_sliding8-SD_SIGNAL_sliding8)
6	35,23	47,17	22,46	10,35	5,16
10	23,215	14,65	6,38	2,73	1,27
14	14,755	4,47	2,15	1,09	0,63
18	9,55	1,87	0,83	0,38	0,17
22	6,155	0,58	0,246	0,12	0,057
26	3,975	0,2	0,0897	0,0474	0,0237
30	2,635	0,0881	0,04	0,0204	0,011

APPENDIX B: COMBINED SD AND PACKET ERROR SIMULATIONS

SD and Packet Errors per 1000-bytes Packets for an SNR of 20.75 dB and TDS of 50 ns at 36 Mb/s



SD and Packet Errors per 1000-bytes packets for an SNR of 26.5 dB and TDS of 50 ns at 54 Mb/s



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicants: J. Boer et al.
Case: 6-2-2-5
Serial No.: 10/621,862
Filing Date: July 17, 2003
Art Unit: 2611
Examiner: Leila Malek

Title: Signal Quality Estimation in a Wireless Communication System

---

ATTORNEY AFFIDAVIT

I, the undersigned, hereby declare and state as follows:

1. I worked under the supervision of Wayne L. Ellenbogen, Esq. (Reg. No. 43,602) to prepare the Declaration of Prior Invention submitted on December 13, 2007 (hereinafter "Declaration"), in the above-identified application.

2. At the time that the Declaration was prepared and submitted, none of the four inventors of the above-referenced patent application were employed by the assignee or a related entity. Moreover, none of the four inventors lived within the United States.

3. On or about October 23, 2007, I sent an electronic mail message requesting current contact information for inventor Ra'anan Gil. A copy of this electronic mail message is attached hereto as Exhibit 1.

4. On or about October 24, 2007, I received an electronic mail message including current contact information for inventor Ra'anan Gil. A copy of this electronic mail message is attached hereto as Exhibit 2.

5. On or about October 24, 2007, I sent an electronic mail message to inventors, including Ra'anan Gil, requesting assistance in preparing the Declaration. A copy of this electronic mail message is attached hereto as Exhibit 3.

6. On or about November 8, 2007, I sent an electronic mail message to inventors, including Ra'anan Gil, requesting assistance in preparing the Declaration. A copy of this electronic mail message is attached hereto as Exhibit 4.

7. On or about November 19, 2007, I sent an electronic mail message to inventors, including Ra'anan Gil, requesting that they sign the Declaration. A copy of this electronic mail message is attached hereto as Exhibit 5.

8. On or about November 21, 2007, I sent an electronic mail message to inventors, including Ra'anan Gil, requesting that they sign the Declaration. A copy of this electronic mail message is attached hereto as Exhibit 6.

9. On or about November 26, 2007, I sent an electronic mail message to inventor Ra'anan Gil requesting that he sign the Declaration. A copy of this electronic mail message is attached hereto as Exhibit 7.

10. I have not received any indication that any of the five electronic mail messages addressed to Ra'anan Gil and attached hereto as Exhibits 3-7 was not delivered to Ra'anan Gil, nor have I received any response from Ra'anan Gil to the five electronic mail messages addressed to Ra'anan Gil and attached hereto as Exhibits 3-7.

11. All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true.

12. I understand that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

Date: 6/4/08

David E. Shifren
Attorney for Applicant(s)
Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
(516) 759-2641

EXHIBIT 1

David E. Shifren

From: David Shifren
Sent: Tuesday, October 23, 2007 3:56 PM
To: 'janboer@motorola.com'; 'bas.driesen@philips.com'
Cc: Wayne L. Ellenbogen
Subject: Patent applications
Sensitivity: Confidential
Attachments: Boer_AFF.pdf; Boer5.pdf; Boer6.pdf

Gentlemen,

I'm assisting Wayne Ellenbogen in prosecuting two patent applications based on work you did for Agere (I've attached them as Boer5.pdf and Boer6.pdf). I believe that we may be entitled to "swear behind" some references (none of which are assigned to your present employers) based on Agere ASIC Team Design Note WADN129, Revision C ("Exhibit 1" of Boer_AFF.pdf), which I understand shows results obtained from a simulation of the claimed inventions.

Two questions:

1) Assuming that this document does in fact disclose the claimed inventions, do you have an earlier revision (e.g., Revision A) that might show similar experimental results but with an earlier date?
2) Do you have contact information (preferably e-mails) for Ra'anan Gil and Kaj Kriedte?

Thank you very much for your help.

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

EXHIBIT 2

David E. Shifren

From: Boer Jan-ajb116 [janboer@motorola.com]
Sent: Wednesday, October 24, 2007 3:51 AM
To: David Shifren; bas.driesen@philips.com
Cc: Wayne L. Ellenbogen
Subject: RE: Patent applications
Sensitivity: Confidential

David,
I only have revision C.
Contact information:
kriedte@motorola.com
vr_gil@netvision.net.il
Regards,
Jan Boer

From: David Shifren [mailto:des@rml-law.com]
Sent: Tuesday, October 23, 2007 9:56 PM
To: Boer Jan-ajb116; bas.driesen@philips.com
Cc: Wayne L. Ellenbogen
Subject: Patent applications
Sensitivity: Confidential

Gentlemen,

I'm assisting Wayne Ellenbogen in prosecuting two patent applications based on work you did for Agere (I've attached them as Boer5.pdf and Boer6.pdf). I believe that we may be entitled to "swear behind" some references (none of which are assigned to your present employers) based on Agere ASIC Team Design Note WADN129, Revision C ("Exhibit 1" of Boer_AFF.pdf), which I understand shows results obtained from a simulation of the claimed inventions.

Two questions:
1) Assuming that this document does in fact disclose the claimed inventions, do you have an earlier revision (e.g., Revision A) that might show similar experimental results but with an earlier date?
2) Do you have contact information (preferably e-mails) for Ra'anan Gil and Kaj Kriedte?

Thank you very much for your help.

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

EXHIBIT 3

David E. Shifren

From: David Shifren
Sent: Wednesday, October 24, 2007 9:56 AM
To: 'Boer Jan-ajb116'; bas.driesen@philips.com; 'kriedte@motorola.com'; 'vr_gil@netvision.net.il'
Cc: Wayne L. Ellenbogen
Subject: Patent applications
Sensitivity: Confidential
Attachments: Boer_AFF.pdf; Boer5.pdf; Boer6.pdf

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1) Am I correct that this document does in fact disclose experimental results obtained from simulations of the claimed inventions?
2) Do you have an earlier revision (e.g., Revision A) that might show similar experimental results but with an earlier date?

Thank you very much for your help.

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

EXHIBIT 4

David E. Shifren

From: David Shifren
Sent: Thursday, November 08, 2007 10:51 AM
To: 'Boer Jan-ajb116'; 'bas.driesen@philips.com'; 'kriedte@motorola.com'; 'vr_gil@netvision.net.il'
Cc: Wayne L. Ellenbogen
Subject: RE: Patent applications
Sensitivity: Confidential

Gentlemen,

Have any of you had a chance to work on the matter noted below? Thank you.

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

From: David Shifren
Sent: Wednesday, October 24, 2007 9:56 AM
To: 'Boer Jan-ajb116'; bas.driesen@philips.com; 'kriedte@motorola.com'; 'vr_gil@netvision.net.il'
Cc: Wayne L. Ellenbogen
Subject: Patent applications
Sensitivity: Confidential

Gentlemen,

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1) Am I correct that this document does in fact disclose experimental results obtained from simulations of the claimed inventions?
2) Do you have an earlier revision (e.g., Revision A) that might show similar experimental results but with an earlier date?

Thank you very much for your help.

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

EXHIBIT 5

David E. Shifren

From: David Shifren
Sent: Monday, November 19, 2007 4:32 PM
To: 'Boer Jan-ajb116'; 'bas.driesen@philips.com'; 'kriedte@motorola.com'; 'vr_gil@netvision.net.il'
Cc: Wayne L. Ellenbogen
Subject: RE: Patent applications
Sensitivity: Confidential
Attachments: Boer_AFF.pdf; Boer5.pdf; Boer6.pdf

We need to prepare and file the below-referenced affidavit as soon as possible, and no later than Thursday, November 29. In order to give us ample time to prepare the affidavit (and for you to sign it), could you please research the matters referenced below no later than Monday? I've attached copies of the cited documents. Thank you very much. To reiterate:

I'm assisting Wayne Ellenbogen in prosecuting two patent applications based on work you did for Agere (I've attached these applications as Boer5.pdf and Boer6.pdf). I believe that we may be entitled to "swear behind" some references (none of which are assigned to your present employers) based on Agere ASIC Team Design Note WADN129, Revision C ("Exhibit 1" of Boer_AFF.pdf), which I understand shows results obtained from a simulation of the claimed inventions.

1) Am I correct that this document does in fact disclose experimental results obtained from simulations of the claimed inventions?
2) Do you have an earlier revision (e.g., Revision A) that might show similar experimental results but with an earlier date?

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

From: David Shifren
Sent: Thursday, November 08, 2007 10:51 AM
To: 'Boer Jan-ajb116'; 'bas.driesen@philips.com'; 'kriedte@motorola.com'; 'vr_gil@netvision.net.il'
Cc: Wayne L. Ellenbogen
Subject: RE: Patent applications
Sensitivity: Confidential

Gentlemen,

Have any of you had a chance to work on the matter noted below? Thank you.

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

From: David Shifren
Sent: Wednesday, October 24, 2007 9:56 AM
To: 'Boer Jan-ajb116'; bas.driesen@philips.com; 'kriedte@motorola.com'; 'vr_gil@netvision.net.il'
Cc: Wayne L. Ellenbogen
Subject: Patent applications
Sensitivity: Confidential

Gentlemen,

I'm assisting Wayne Ellenbogen in prosecuting two patent applications based on work you did for Agere (I've attached them as Boer5.pdf and Boer6.pdf). I believe that we may be entitled to "swear behind" some references (none of which are assigned to your present employers) based on Agere ASIC Team Design Note WADN129, Revision C ("Exhibit 1" of Boer_AFF.pdf), which I understand shows results obtained from a simulation of the claimed inventions.

1) Am I correct that this document does in fact disclose experimental results obtained from simulations of the claimed inventions?
2) Do you have an earlier revision (e.g., Revision A) that might show similar experimental results but with an earlier date?

Thank you very much for your help.

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

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message. Thank you.

EXHIBIT 6

David E. Shifren

From: David Shifren
Sent: Wednesday, November 21, 2007 11:04 AM
To: 'bas.driesen@philips.com'; 'vr_gil@netvision.net.il'
Subject: Affidavits
Importance: High
Sensitivity: Confidential
Attachments: Boer_AFF.pdf

As you can see below, Jan and Kai have already signed and returned their affidavits. Could each of you please sign and return the attached affidavits? Please either fax them or email them to me, then mail me the original signatures. If you submit receipts, we can reimburse you for any expenses you incur (e.g., fax charges or postage). Thank you very much.

Also, please note that, as discussed below, not only are you legally obligated to sign these affidavits pursuant to an agreement with Agere which is still in force, but that signing these affidavits will help expedite allowance of these patents in your names, which I assume will have professional benefits. Thank you very much for your help.

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

From: Boer Jan-ajb116 [mailto:janboer@motorola.com]
Sent: Wednesday, November 21, 2007 10:06 AM
To: David Shifren
Cc: Wayne L. Ellenbogen
Subject: RE: Patent applications
Sensitivity: Confidential

Thanks David.
You are very convincing.
I have faxed the affidavits, signed by Kai Kriedte and myself.
Best regards,
Jan Boer

From: David Shifren [mailto:des@rml-law.com]
Sent: Tuesday, November 20, 2007 4:36 PM

EXHIBIT 7

David E. Shifren

From: David Shifren
Sent: Monday, November 26, 2007 3:50 PM
To: 'vr_gil@netvision.net.il'
Subject: FW: Affidavits
Importance: High
Sensitivity: Confidential
Attachments: Boer_AFF.pdf

Ra'anan,

I have now received signed affidavits from all of your co-inventors.

If you have any questions or concerns regarding these affidavits, please let me know. Otherwise, I hope to receive your signed affidavit at your earliest convenience, but no later than Wednesday.

As I've previously noted, you are under a legal obligation to sign these affidavits. Thank you very much.

Best regards,

David E. Shifren, Esq.
USPTO Reg. No. 59,329
Ryan, Mason & Lewis, LLP
90 Forest Avenue
Locust Valley, NY 11560
Telephone: 516-759-2641
Fax: 516-759-9512
E-mail: des@rml-law.com

From: Bas Driesen [mailto:bas.driesen@philips.com]
Sent: Thursday, November 22, 2007 10:16 AM
To: David Shifren
Subject: Re: Affidavits

David,

Here is the requested.
I am sending a paper copy per mail today.

Regards,
Bas

RELATED PROCEEDINGS APPENDIX

None